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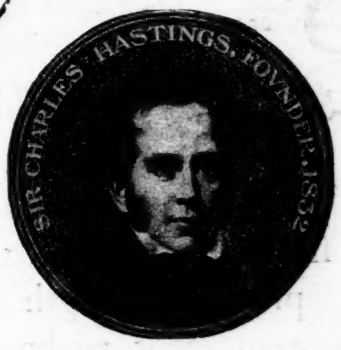

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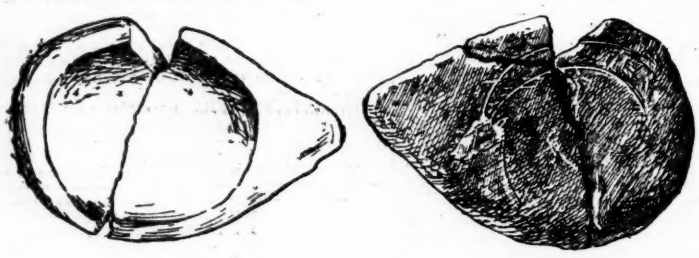

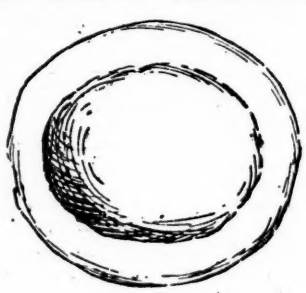

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EIGHTY-EIGHTH ANNUAL MEETING

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PROCEEDINGS OF SECTIONS.

SECTION OF PATHOLOGY AND BACTERIOLOGY.

Professor J. LORRAIN SMITH, M.D., F.R.S., President.

INTRODUCTION BY THE PRESIDENT.

THE discussions which have been arranged for the Section may be regarded as representing the three main branches of pathology.

In the discussion on cerebro-spinal meningitis we will learn from the bacteriologists the results of recent investigation. The experience of the war has added to our knowledge of the infection and its treatment, and from this discussion we hope to obtain not only a wider knowledge but also further guidance for the practical handling of outbreaks of the disease.

In discussing liver atrophies we have to deal with a subject which has been taken up primarily in the form of morbid anatomy. It is further a subject which has recently claimed much attention and study because of the occurrence of the disease in a number of patients in military hospitals. While the investigation of this type of disease has so far been chiefly an inquiry into the interpretation of the anatomical changes, its possible relationship to syphilitic infection and the treatment of syphilis opens up questions the answer to which demands other forms of inquiry.

In the discussion on tumour growth we propose to concentrate our attention on the results of experimental inquiry. Tumour growth as a subject of investigation is one of the most difficult in the whole range of medicine. It has been attacked from many points of view; but the study of the conditions which determine growth in experimentally produced tumour is of outstanding interest.

The development of the science of pathology has led to the division of the subject into the three branches—morbid anatomy, experimental pathology, and bacteriology, and the discussions illustrate and exemplify the division. The methods of the three branches differ widely, and there is a corresponding difference in the training and experience which is required for their application. The science has advanced too far for anyone to embody equally in his work all types of inquiry. One worker will devote himself to chemical inquiry, another to variations in histological structure, and another to bacteriology. Hence arises a certain limitation in the scope of individual researches, with the general result that in pathology separation into compartments begins to take place. Yet there remains the essential unity of the problem which each case of disease presents. The present occasion on which a variety of problems and methods are presented, while it illustrates the diversity which has arisen, seems to me a suitable opportunity for emphasizing the essential unity which underlies the division. If we restrict our attention to one type of investigation we are apt to lose sight of the unity of the problem. There are few problems in pathology which do not call for investigation by several methods, and often indeed by all the methods that are available. The pathological investigation of the deficiency disease beri-beri was in the first instance a morbid anatomy investigation of the structural changes which occur in the nervous and other tissues affected. Later the investigation became an experimental inquiry into the deficiency factor and the production of the disease in animals put on a deficiency diet. From this we have been able to study experimentally the development of functional failure in the affected organs and the extent to which at the different stages of the disease permanent structural changes have occurred, and lastly, the degree of recovery which is possible when the deficiency factor has been removed. The study of this disease is a combination of anatomical and experimental inquiries.

Another illustration is afforded at the present day by the pathological investigation of encephalitis lethargica. This disease is now receiving more exact definition by clinical observers, and at the same time the study of its morbid anatomy has shown the presence of certain changes in the brain. At the stage we have now reached we await the introduction of experimental inquiry. This will succeed when it has isolated and defined the etiological factor at work, and we may discover that we have to do with an infective agent to be dealt with by the methods of bacteriology. The complete investigation of this disease will involve all types of inquiry.

Pathological investigation receives much criticism on the ground that it is one-sided. The researches are stigmatized as too anatomical, too bacteriological, and so forth. So far as this criticism is sound it points to the insufficiency and danger of attacking problems from one point of view.

The clinician, in dealing with a case of disease, has the whole problem which the case presents obtruded on his attention, and when he turns to incomplete pathological investigations for the means of interpreting his difficulties he is apt to experience disappointment. This disappointment is due not so much to the fact that the pathologist occupies a point of view which differs from that of the clinician, but to the limitations of the pathological inquiry. The research does not go far enough. It often happens that morbid anatomy supplies the method for the introductory stage of an investigation, but it must be followed by experimental or by bacteriological inquiry, and the results of these must be often referred back to the morbid anatomist for criticism and verification. On the other hand, failure to solve a given problem is often due to the essential limitations of the methods of inquiry, and when this is clear we have perforce to admit that the solution is beyond our reach, but failure should never be admitted till all the known methods of inquiry have been applied. Pathology, like other branches of medicine, derives its methods ultimately from biology. These methods may require modification and elaboration for each particular problem, but change them as we may they are all still essentially biological methods, and no problem has been fully investigated till all the methods known to science have been applied. Failure which calls for criticism arises when pathology is not carried far enough. The reason why pathology has not solved the problem of encephalitis lethargica is, in the first instance, because it has not yet successfully brought it within the range of experimental inquiry. A certain amount of anatomical investigation has been carried out. This, when it is finished, will be nothing more than a contribution to the complete investigation. It will form an essential part of the complete investigation, but however extensive it may be, it will not solve the whole problem of the disease. Now, may I ask, should this lead us to discard morbid anatomy as a method of investigation? Are we justified in describing the morbid anatomist in terms of abuse as a useless cumberer of the ground? Shall we derisively speak of him as a deadhouse pathologist, and insinuate that his inquiries and results can have little or no bearing on any real investigation of the process of disease? Such criticisms are ill informed and arise from an insufficient grasp of the problem as a whole. The inquiry is incomplete, and must be extended by other methods, and probably we will find as a consequence a demand for still further study of the anatomical changes in the brain. We must admit, however, that we are tempted to be content with partial inquiries. Complete inquiry is difficult and involves the expenditure of much time and effort. Biology as a science is based upon chemistry and physics, and branches out in medicine into all the varied departments of anatomy and physiology. To complete pathological inquiries we must have at our disposal the means of applying all the methods of these basal sciences. In pathological departments we require a provision of staff and equipment which is difficult to obtain, and here I come to one of the fundamental reasons for the limitations of our inquiries. Our pathological departments are too frequently fitted up and staffed merely to aid the clinicians by the methods of laboratory diagnosis. Too often the interest in a case dies away at the point when the diagnosis

has been reviewed in the light of a *post-mortem* examination or by the aid of a bacterial culture. No real attempt is made to continue the investigation until there is obtained an interpretation of the whole phenomena of the disease in its origin, progress, and results. The application of pathology to clinical diagnosis serves a useful purpose, but it is only an introduction to the problems which the case presents.

Let us take a case of Addison's disease. We find at *post-mortem* examination, let us say, that the glandular tissue of the suprarenal has been replaced by tuberculous foci. The diagnosis of Addison's disease is confirmed by the morbid anatomist. He has shown that the disease is a form of tuberculosis; but the problem of this particular disease remains unsolved, for we have still to show what were the conditions which determined the settlement of tuberculous infection in this particular organ of the body. The disease is a striking example of the question which arises in dealing with the pathology of all infections—namely, the incidence or distribution. What is it that determines the distribution of the tuberculous infection in the various organs? In one case it is chiefly in the lymph glands, in another it is in the lungs, and in rare cases it is in the suprarenal glands. The diagnosis of the case with which we are tempted to be satisfied—and I might say, indeed, with which we are often compelled to be satisfied—is merely an introduction to the fundamental study of the conditions of susceptibility and resistance to infection in the various organs of the body.

Progress in pathological investigation will come the sooner the more we realize the extent of the problem. At the present day we are all conscious of the need for better organization of our medical service, and this conviction has been strengthened as a result of our war experience. What pathology requires is to be put in a position to carry out complete investigation, and I am convinced that in making this claim we will have the support of the whole profession.

In the discussions which we have arranged we will have the opportunity of considering the results which have been obtained by various methods. It is my hope also that in reviewing the whole programme we may obtain a clearer conception of the extent of the problem which is before us in the reorganization of the pathological branch of medical investigation, and in equipping and staffing the pathological departments of hospitals and medical schools.

DISCUSSION ON THE BACTERIOLOGY OF CEREBRO-SPINAL MENINGITIS.

OPENING PAPER

BY

JOSEPH A. ARKWRIGHT, M.D., F.R.C.P.,

Assistant Bacteriologist, Lister Institute of Preventive Medicine.

THE epidemic of cerebro-spinal meningitis during the war has produced an enormous amount of careful bacteriological work. Whatever its immediate practical value and the fate of the conclusions drawn from the data by the different workers, much of the work itself has been extraordinarily thorough and accurate, and must have a value in elucidating the general problems of the classification of bacteria, their liability to change, and the relation of pathogenic bacteria to their nearly related non-pathogenic congeners. The close study of the occurrence, position and persistence of meningococci in the nasopharynx of carriers will also be of general value as an example of the relation of bacterial infection to the course of epidemics of disease and as affording facts concerning the spread of an air-borne disease which infects the upper air passages.

[Dr. Arkwright has prepared accounts of work done before the war, of the state of knowledge at the outbreak of war, of the bacteriological work done during the war, including serological observations, of cultural work, and of notable contributions to the pathology, and also a bibliography which it has not been found possible to reproduce here.]

Diagnosis and Classification of Meningococci.

Among the many points of importance in the great mass of work that has been done during the war, the chief interest centres round the classification of the meningococcus both for practical purposes and from the theoretical standpoint. On this largely depends the ability to recognize the meningococcus in the nasopharynx and the means to be used for this purpose, and also the desirability and possibility of detecting and isolating carriers.

The diagnosis and classification of the meningococcus may be made (1) by the morphology of the cocci and their colonies, and by cultural means, including fermentation; (2) by agglutination with a polyvalent serum with or without absorption of agglutinins, or (3) by agglutination and absorption of agglutinins using monovalent serums.

It is agreed that meningococci can be divided by agglutination into two or more main groups, but the sharpness of definition of the principal groups and the number and distinctness of small accessory groups which contain so-called aberrant strains are not fully agreed upon.

The possibility of further division of the two chief groups is also generally accepted; but the number of subgroups and the degree to which they overlap, their constancy in culture and in the human body, and the need or desirability of these finer subdivisions for practical purposes, are matters about which there is wide divergence of opinion.

Gordon and his co-workers maintain that 98 per cent. of spinal meningococci fall readily into four groups which are quite distinct and have only minor bonds of relationship; that these four groups can be distinguished by simple agglutination, but that the grouping is assisted and confirmed by the method of absorption of agglutinins. On the other hand, Griffith and Scott appear to have quite clearly shown that the classification into four groups is not inclusive of all strains, and that it is artificial and only accomplished by an arbitrary selection of standard strains for making the type serums. Moreover, that classification on these lines might equally well be carried still further, and that each of the two main groups might be divided into three or four subgroups, and that the more it is attempted to establish these finer subdivisions, the more other points of relationship come into prominence and the less sharply defined the main two groups appear to be.

Griffith and Scott further support these observations on the spinal strains by showing that strains from the nasopharynx have a special tendency to show affinities with both of the main groups or two or more subgroups. They also hold that their researches show that strains from the nasopharynx can be diagnosed by cultural means alone, and that agglutination tests, if sufficiently comprehensive, support these cultural results.

The General Position of Serological Diagnosis.

Before considering further the diagnosis of the meningococcus by serological tests it will be well to glance briefly at the general question as it relates to other kinds of bacteria.

In studying any pathogenic organism one of the most important data to settle is how this micro-organism can be identified conclusively when met with, and how it can be distinguished from other similar micro-organisms. Closely connected with this problem is the question why the organism is considered to be pathogenic and the cause of the disease with which it is connected.

To take the latter point first, in spite of the formulation and to a large extent the acceptance of the famous postulates of Koch, nevertheless these desiderata are only forthcoming in a very few of the diseases which are believed to be due to definite micro-organisms. In other cases the thesis that the disease is produced by infection with a certain bacterium is generally supported by analogy and by a mass of circumstantial evidence giving a strong *a priori* foundation for the claim, which is finally clinched by some one or more very strong special arguments which are different in each individual disease. These "conclusive" arguments are of very different kind and value in different cases.

Thus the *B. typhosus* cannot readily be made to reproduce a disease like enteric fever in animals (unless Besredka's recent work on the sensitization of rabbits with bile is confirmed). Its acceptance, however, as the infective agent is amply justified by its almost constant presence in the blood of cases during the first week of fever, and the appearance of antibodies to the bacillus in the blood of the patient during the course of the disease. In addition to this there are very definite instances of laboratory infection.

B. dysenteriae produces death in rabbits and lesions in the bowel very like those which are found in man, though in animals it does not as a rule produce a continued state of disease.

The meningococcus, while it is not capable of producing a characteristic infective disease in animals, is constantly found in the meninges and purulent cerebro-spinal fluid of a certain class of cases of meningitis, which can also be diagnosed clinically, and *post mortem* on macroscopical evidence.

In any case the definite and certain recognition of a pathogenic bacterium after its removal from the body is of great importance, otherwise the statement that an organism is the cause of the disease, since it is in constant association with the disease, merely becomes the equivalent of saying that some uncharacterized bacterium is constantly found under the circumstances—a very different statement.

B. typhosus, though not so susceptible to the animal test as some other pathogenic bacteria, possesses the characteristic of remarkable uniformity when isolated, and thus it has the advantage of being readily recognized. The agglutination of the *B. typhosus* by specific serums has not only been studied for a longer time and probably by more workers than that of any other kind of bacterium, but it has been the special typical instance which has been taken when the subject of bacterial agglutination has been investigated. It so happens that the reaction between the *B. typhosus* and its appropriate serum is more uniform than in most cases, if not more than in any other instance, and as the serological relationships of the *B. typhosus* to other bacteria are with few exceptions remote, they seldom, if ever, complicate the diagnosis of the bacillus.

Value of Agglutination.

These facts relating to the agglutination of the *B. typhosus*—namely, that it was the prototype of all bacterial agglutination, that it is singularly constant and highly specific—appear to me to have given a prestige to the agglutination test which it does not quite deserve.

Even amongst such constant organisms as *B. typhosus*, *B. paratyphosus* A, and *B. dysenteriae* (Shiga) it must be remembered that inagglutinable and spontaneously agglutinable strains or cultures occur and thus depreciate the value of the test. I have recently been able to demonstrate[1] that variations of the *B. dysenteriae* (Shiga) can readily be obtained which show very greatly altered agglutination reactions.

If the value of agglutination for the identification of almost any other kind of bacterium is considered it is found that the course is not such plain sailing, though some pathogenic organisms present a fair degree of uniformity—for example, *B. paratyphosus* A and *B. dysenteriae* (Shiga). On the other hand, the attempt to identify by agglutination strains of the *B. paratyphosus* B group or *B. dysenteriae* (Y-Flexner) may immediately raise difficulties, and the unity or multiplicity of the vibrios of cholera and paracholera are matters which are far from settled. In the case of the *B. paratyphosus* B group (as has recently been detailed by Schütze)[2] cultures of bacteria from swine and other animals and from food poisoning cases may agglutinate equally and with the same serums as *B. paratyphosus* B strains from cases of "enterica" in man; and some strains resembling *B. paratyphosus* B, which have also come from enterica patients (*B. paratyphosus* C or Hirschfeld strains), do not agglutinate with all true *B. paratyphosus* B serums, though closely resembling this bacillus culturally and being agglutinable by serums made with other strains of the same bacillus.

The *B. dysenteriae* group also present difficulties of the same kind. An agglutination test with a serum prepared from a casually chosen strain of this group is of little value for diagnostic purposes, for its reaction embraces only a few members of the group. In this case, however, the diagnosis is much helped by the fact that at any rate a very large number of strains from cases of dysentery, selected in the first instance by their sugar reactions, are agglutinated by a serum prepared with one well known strain—the *B. dysenteriae* Y of His and Russell, as was shown by Morgan (1911).[3]

Absorption of Agglutinins.

In order to overcome the difficulties of these uncertain and apparently non-specific reactions, the method known as absorption of agglutinins, devised by Castellani for dealing with streptococci and used by him for the elucidation of mixed infections, was adopted by Boycott and Bainbridge for investigating the paratyphoid group.

Schütze (1920) has repeated and extended the work of Uhlenhuth and Bainbridge, and has shown that the *B. paratyphosus* B—Aertrycke group may be divided by the absorption technique into at least nine subgroups, and a number of further subdivisions which he calls substrains. A "substrain" is separable from the "superstrain" with which it is connected by the result of an absorption experiment in which the "substrain" is shown to absorb only its own agglutinins from a serum made with the "superstrain." He also records the derivation of a "substrain" from its corresponding "superstrain" in culture.

It seems certain that an attempt to classify this group by simple agglutination alone is not quite satisfactory, and that if absorption of agglutinins is taken as the criterion, the multiplicity of groups and subdivisions becomes confused and excessive for practical purposes. The researches of Andrewes and Inman (1919)[4] on the grouping of *B. dysenteriae* (Flexner-Y) by agglutination and absorption of agglutinins have focussed attention on the very numerous varieties of this group, also as regards their serological properties.

This inability to rely on the serum prepared from one strain for the identification of others, and the facility with which groups apparently uniform may be divided by "absorption" into a large and indefinite number of subgroups, are therefore phenomena not confined to any one group of bacteria. The widespread character of this experience seems to throw light on the limits of these methods of classification.

From these considerations it may be concluded that agglutination amongst nearly allied bacteria is an extremely valuable diagnostic test, but only final and decisive in a rather limited number of cases, and even then not infallible. It has the advantage of being a fairly inclusive test if due precautions are taken to select a suitable (polygerent) strain with which to prepare the serum.

Absorption of agglutinins for purposes of classification has the disadvantage that by its means strains which appear to be closely allied on other grounds are separated, and cross-connexions are found which make the formation of definite groups difficult and their limits uncertain. One undoubted merit of "absorption" is that it can be used when direct agglutination fails because the culture under examination is (1) inagglutinable, though capable of absorbing, or (2) spontaneously agglutinable, or (3) when the serum available is polyvalent and has far too large a scope for the purpose in hand.

If it were certain that an exact knowledge of the agglutinable substance, agglutinogens and agglutinins, were of unique importance for establishing the true relationship by descent of bacteria, then the method of absorption of agglutinins would have much to recommend it for classificational purposes. It is at the best, however, more complicated than simple agglutination and therefore more liable to certain errors. The assumption of its prime importance cannot at present be considered as fully justified in the face of the unexpected divisions and cross-relationships revealed by this technique, and the very striking changes which some strains undergo in culture.

If, however, it were maintained that a sound classification of pathogenic bacteria would be more securely based on the reactions produced in the animal body than on their assumed evolutionary kinship, it would be necessary to consider whether agglutination and absorption had any special relation to infectivity, virulence, or toxin production. These two classes of characters have, however, been found to vary independently in some cases, as Tulloch (viii, 1919)[5] has shown for the agglutination types of *B. tetani* and their toxin, and Miss Robertson[6] for the *Vibrion septique*.

Certain variations in *B. dysenteriae* (Shiga) which I have found to occur *in vitro* were associated with remarkable changes in the agglutination properties, but did not seem to be closely related to the toxicity of cultures. In the same way the cases of cerebro-spinal fever associated with different serological types of the meningococcus have not been shown to have any considerable differences clinically.

The above remarks are not intended as a criticism of the very arduous work undertaken as a research into the uses

and limits of the method of absorption of agglutinins, and as an attempt to determine how far relationship (evolutionary or physiological) can be detected by this means. It is only when it is maintained that this method is final and necessary as a means of elucidating relationship and establishing a natural classification that the claim appears to outrun the evidence.

Absorption of Agglutinins in the Meningococcus Group.

The test of absorption of homologous agglutinins from a serum was used by Gordon in order to diagnose more accurately meningococcus-like cultures, and he was led to exclude a number of strains which were found in the nasopharynx by this means alone. He was also enabled to place more definitely certain strains of Groups III and IV. Tulloch by this method detected three subgroups in Group II, and thus explained defects in the behaviour of this group.

Gordon's four groups never quite covered all the spinal strains, though he found that 98 per cent. could be classified. He and his colleagues found that in order to be able to assign so large a proportion of strains to their appropriate groups, the technique of agglutination and absorption must be very exact as regards the details of the procedure, and that the time spent in immunizing the rabbits was of considerable importance; moreover, that the laboratory worker must be highly trained and in constant practice. Thus the work of others who found difficulty in reducing the strains to four distinct groups is criticized on account of the length of time over which the rabbits affording type serums were subjected to inoculations, since it was held that a prolonged immunization made the resulting serum too inclusive in its qualities.

The demand for such precision and hardly-come-by niceties of method requiring such arduous training unfortunately discounts as valueless much of the control work done by others. It recalls the technique by which Procrustes applied an arbitrary and inelastic standard to his guests.

Some of those who have experience of the cross-relationships demonstrable between different groups of meningococci as evidenced by the occasional change-over of a strain from one group to another, the equal action of serum prepared from one strain on cocci from different groups, or the equal agglutination of one strain by serums made from cultures belonging to different groups, will hesitate before adopting a procedure which leads to further subdivisions.

The knowledge that the allied class of gonococci also can readily be divided into subgroups which independently cross-agglutinate with meningococcus groups, and that some strains of gonococci more nearly resemble serologically some meningococci than other groups of gonococci, makes one pause before accepting such methods of classification as final.

If it were proved that a knowledge of the subgroups were of value for the production of therapeutic serum or for any such specific purpose, then this clasification would become immediately of great importance.

Isolation of Carriers.

Attempts to correlate the isolation of carriers with the prevention of the disease are very difficult, and, considering the apparent capriciousness of the distribution of the disease, and the comparative rarity with which it attacks more than one person in a house or more than one soldier in a hut and the large number of carriers often found, the chances of demonstrating the success of an isolation policy must be very rare.

However, a considerable advance has been made by accumulated knowledge of the rise and fall of cases in a small area with the change in the carrier rate. The practical measures required to obviate a serious outbreak are matters which have been especially studied by Dr. Glover (1918).[7] In my opinion the position of the carrier question may be stated as follows:

1. The question whether carriers should be isolated depends, in the first instance, on our ability to recognize the meningococcus certainly in the nasopharynx. It must be borne in mind that at present no really final answer can be given to the question whether a given Gram-negative coccus is truly an infective meningococcus or not, unless it comes from the meninges.

2. For diagnosis, cultural tests if very carefully carried out are probably at least as good as any other, but in view of the large number of somewhat similar organisms in the throat apart from meningococci, especially if regard is had to certain epidemics of bronchitis, etc., it seems desirable to use an agglutination test in addition. Polyvalent horse serum is probably too inclusive, and single rabbit serums would require to be too numerous. A polyvalent rabbit serum prepared with several strains from the meninges of as different serological reactions as possible appears to be the most suitable diagnostic serum.

3. The policy of isolation, even if desirable on other grounds, must depend on the proportion of the population found to be carriers. If this proportion is large—for example, 10 or even 50 per cent. in non-contacts—the procedure seems to be an impossible one.

4. It seems doubtful if we know much about the proportion of carriers in the population between and at the earliest stages of epidemics, and the relation of the rise and fall of the numbers of cases to those of carriers at different periods of the epidemic. To ascertain these facts with any accuracy it seems almost essential that the same workers using the same technique should make observations at intervals over very long periods.

5. In all but very exceptional circumstances the detection and isolation of carriers appears to be a proceeding which should not be attempted in the present state of our knowledge.

6. Various methods for the disinfection of carriers have been devised, but this most difficult problem has not met with any decisive solution.

Therapeutic Serum.

The best methods of preparing therapeutic serum, and whether it should be polyvalent or monovalent, are still vexed questions. They are very difficult problems, since there is no recognized laboratory test of the efficacy of the serum which can be taken as an indication of its clinical value. Virulence and toxicity tests of living and dead cultures, and of preparations of "endotoxin," have been tried on mice and guinea-pigs in this country, on the Continent, and in America, but as far as I can ascertain there is no agreement in different laboratories as to the value of these tests.

Gordon in January, 1918, published a method for preparing "endotoxin" and standardizing serum by testing its efficacy in protecting mice against the toxin. Dopter reported very good results with univalent serum. Flexner's serum made at the Rockefeller Institute, with which some of the best results were claimed, and which has been credited with good results in a relatively small number of cases during the recent epidemic, is polyvalent, and care is now taken to include both the meningococcus and the parameningococcus in the cultures used.

I should like to enter a plea for multivalent serum. Most of the best results recorded have been obtained with multivalent serums. The type of meningococcus in any given case cannot as a rule be known for a day or two, and the difficulty of having two or more serums available is great, and must much increase the practical difficulties and cost of treatment.

CONCLUSIONS.

To sum up what appears to me to be the present state of our knowledge as the result of the advances made during the war:

1. The position of the meningococcus as the causal organism has been confirmed. Cultural methods have been improved and are at least as efficient as serological methods for diagnosis, but both means should be used.

2. The occurrence of two main groups of meningococcus corresponding to Dopter's meningococcus and parameningococcus has been recorded in all epidemic centres, and in about equal numbers.

3. These two main groups are capable of division into a further indefinite number of subgroups by making serums from a number of single strains for agglutination, and by the use of the absorption of agglutinins technique. Gordon's Types III and IV have a special prominence among these subgroups, but whether this is due to the specially selected strains for the diagnostic serums or to a greater definiteness of these two subgroups is not quite clear.

4. The meningococci from the nasopharynx compose a very ill-defined group, and though many agree absolutely with the commoner strains from the meninges, others correspond only to the rarer meningeal strains. Other strains, again, show no relationship to strains from the meninges by agglutination tests, but a close affinity is apparently revealed when they are used to make agglutinating serums. In these circumstances, and since no

absolute criterion of a meningococcus is known, it is arbitrary either to include these among the meningococci or to exclude them.

5. The contacts and "non-contacts" who carry the meningococcus in the nasopharynx during an epidemic are so numerous that it is neither necessary nor desirable to attempt isolation of carriers. It is very probable that even when cases of meningitis first appear at the beginning of an epidemic the number of carriers is often too high to make an isolation policy possible, but the data for forming an opinion on this point are not very numerous.

6. The manufacture of therapeutic serum still needs much research and observation. In order to gain more knowledge on the value of different methods of immunization of horses and of laboratory tests of the therapeutic efficiency of serum, it is very necessary that the reference numbers on phials of serum should be carefully noted by the medical men who administer the serum, and that the result of its use should be reported in all cases to those responsible for its manufacture.

Only in this way can evidence be obtained of the value of special methods of manufacture, and progress be made.

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BACTERIOLOGICAL STUDIES OF CEREBRO-SPINAL FEVER AMONG TROOPS (1914–1918).

BY

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BETWEEN 1914 and 1918 cerebro-spinal fever prevailed with varying frequency both among troops and in the civil population of the United Kingdom. At the beginning of 1915 I was invited to act as bacteriological adviser to the War Office for this disease. A central military laboratory was established for the study of cerebro-spinal fever and maintained for a period of four years. Particulars of the researches and observations made during the outbreak have been published in a Special Report (No. 50) recently issued by the Medical Research Council. Some of the chief results may be summarized as follows:

1. *Pathogenic Components of the Meningococcus.*

As the meningococcus is pathogenic to the white mouse on intraperitoneal injection, comparison was made of the pathogenicity of a series of strains when alive, and when killed by ether or by heat (55° C.) respectively. It was found that the pathogenicity of the living coccus for the white mouse was especially pronounced in the case of two out of three strains recently isolated from fulminating cases. When killed, however, these exceptionally virulent meningococci were not materially more toxic for the mouse than other strains, some of which had been cultivated for several months outside the body before being tested in this way.

No certain evidence was found of the presence of extracellular toxin either in cultures in fluid media *in vitro* or in the peritoneal fluid of an infected animal containing the meningococcus in large numbers. An attempt was made, therefore, to define the intracellular constituents of the meningococcus of pathogenic importance. Three different substances were identified. The first of these is an intracellular reducing enzyme or reductase by means of which the living meningococcus exerts a strong deoxidizing action on its immediate environment. This action can readily be demonstrated by adding either washed red blood corpuscles or methylene blue to a dense suspension of living meningococci distributed in tubes in a water bath at 37° C. A change of colour occurs within half an hour, the scarlet of the corpuscles changing to mauve and the methylene blue being bleached. The intracellular reductase of the meningococcus that produces this effect withstands exposure to 55° C. for half an hour (which kills the coccus), but is destroyed in half an hour at 70° C., and in a few seconds at 100° C. As a rule the reductase does not long survive the death of the coccus, and for this reason it furnishes a sensitive macroscopic index of the suitability or otherwise of a fluid medium for that micro-organism provided that the cocci are present in sufficient numbers. The reducing power is far more active when the meningococcus is suspended in serum broth, or cerebro-spinal fluid than in saline or distilled water, and it may disappear rapidly in the presence of disinfectants when these are present in concentration sufficient to injure or kill the coccus. As the meningococcus appears to share this reducing property with other bacteria, the reaction may prove useful when studying the effect of various factors on the vitality or virulence of bacteria.

The second substance detected in the meningococcus possesses haemolytic properties and is in evidence under opposite circumstances to the reductase; thus in young cocci the reducing power is active and haemolytic power in abeyance, whereas in older cocci the converse is the case. This haemolytic agent is improved, if anything, by exposure to 120° C., and as this treatment partially breaks up the meningococcus, it can be employed to demonstrate the presence of the haemolytic substance in the young coccus. The haemolytic substance is soluble in alcohol and acetone but not in ether; and when it is extracted from the coccus in alcohol or acetone and the solvent evaporated off, it can be redissolved in saline.

The third constituent of the meningococcus studied was its endotoxin. When the meningococcus is alive this intracellular toxin appears to be in some kind of union with its cytoplasm. When the coccus dies and conditions of temperature and moisture are favourable, the intracellular toxin is set free by the action of the autolytic enzyme of the meningococcus to which Flexner first drew attention. The endotoxin can be concentrated and stored by washing the growth off a large number of surface plates, centrifuging the cocci out and drying them. The powdered deposit of dried meningococci thus obtained is toxic to mice intraperitoneally in doses of a few milligrams. It was found that meningococcus endotoxin is remarkably thermostable. It withstands boiling for half an hour, but is destroyed in a variable time at 120° C. It is soluble in water, but apparently insoluble in alcohol and ether. It withstands dilute solutions of caustic soda (which can be applied to extract it from the bodies of the cocci), but is destroyed by strong caustic soda. The very important part played by this endotoxin of the meningococcus in producing the lesions of cerebro-spinal fever has been emphasized by therapeutic experience during the recent outbreak.

2. *Serological Types of the Meningococcus.*

By the macroscopic agglutination test (twenty-four hours at 55° C.), checked by the absorption test, meningococci isolated from the cerebro spinal fluid of military cases during 1915 were differentiated into four distinct kinds. Between 1915 and 1919 meningococci from the cerebro-spinal fluid of altogether 526 cases of cerebro-spinal fever were submitted to the agglutination test with these four monotypical agglutinating serums (prepared from rabbits), with the result that 518, or 98 per cent. of them, were identified with one or other of the four types. The frequency of each type was as follows:

	Type I.	Type II.	Type III.	Type IV.
Specimens	195	218	69	36
Percentage	37.66	44.05	11.38	6.91

Approximately 80 per cent. of the cases, therefore, yielded specimens of one or other of the first two groups; and 105 of the specimens—roughly one-fifth—belonged to Types III and IV.

3. *Source of these Meningococci.*

Of the 526 meningococci submitted to examination, 491 came from cases in the United Kingdom, 18 from cases in South Africa, and 9 from cases in the United States. The distribution of types among these meningococci was as follows:

	Type I.	Type II.	Type III.	Type IV.	Total.
United Kingdom...	183	209	64	35	491
South Africa ...	9	6	3	0	18
U.S.A.	3	3	2	1	9

Meningococci coming from cases outside the United Kingdom therefore—which were forwarded as heated and phenolated

suspensions—were included within the four groups, and, whatever the country of origin, the majority of the cocci were found to belong to the first two groups.

Types found in Children.—Of the 491 meningococci investigated from cases of cerebro-spinal fever in the United Kingdom, 462 came from adults and 29 from children. The distribution of types among the meningococci isolated from the cerebro-spinal fluid of cases in children was as follows:

Type I	... ...	8 cases.
Type II	... ...	15 ,,
Type III	... ...	2 ,,
Type IV	... ...	4 ,,

The meningococci from children, therefore, included representatives of all four types—23 out of the 29, or 79 per cent., belonging to the first two groups. It will be observed that Type II was more common than the others.

4. *Result of the Absorption Test.*

The preceding figures refer to the result of observations with the agglutination test alone. In order to check their accuracy the absorption test was applied to 235 of these meningococci. In the case of Type II Tulloch's careful researches showed that the group is complex, and that, in order to include all the specimens, it is necessary to use more than one monovalent serum. The result of the absorption test was a very striking confirmation of the agglutination test; the type found by agglutination being confirmed in the case of 231 out of the 235 meningococci examined.

5. *Further Observations with regard to the Types.*

The majority of observers have found that a patient suffering from cerebro-spinal fever harbours only a single type of meningococcus in his cerebro-spinal fluid. The investigations of Flack, Tulloch, Andrewes and Canti, Embleton, and others have confirmed the statement of v. Lingelsheim as to the constant presence of the meningococcus in the nasopharyngeal secretion of the patient at the onset of cerebro-spinal fever, and have established the new fact that this meningococcus in the nasopharyngeal secretion is of the same serological type as that present in the cerebro-spinal fluid of the case. It has been found also that as a rule either a case or a carrier harbours only a single type of meningococcus throughout the whole period of carrying. The persistency with which cases continue to carry the meningococcus after recovery from the disease has been well demonstrated by the careful observations of Embleton.

6. *Relation of these Types of Meningococcus to One Another, and to the Gonococcus.*

Type I of our outbreak appears to be identical with the true meningococcus, and Type II with the parameningococcus of Dopter. While the chief agglutinin of each type is strictly monotypical and specific, Type III is closely related to Type I, and Type IV to Type II, as is proved by the presence of coagglutinins. In the same way, recent observations have shown that while the specific agglutinins of the meningococcus and gonococcus are distinct, agglutinating serums to Types II and IV of the meningococcus contain abundant coagglutinins for many specimens of the gonococcus.

7. *Identification of the Meningococcus in the Nasopharynx.*

Serological definition of meningococci present in the cerebro-spinal fluid of the cases was necessary in order to prepare the way for accurate identification of the meningococcus in the nasopharynx of carriers, and also to define a basis for specific therapy. At an early stage of the outbreak it was realized that Gram-negative cocci occur in nasopharyngeal secretion that are indistinguishable from the meningococcus in morphological, cultural and fermentative characters, but are serologically distinct from any of the defined types of the micro-organism, and therefore without the same pathogenic significance. These meningococcus-like organisms have been carefully investigated by Tulloch, who has found that they comprise a large number of different serological types. Tulloch's investigation also demonstrated the superior accuracy of monotypical agglutinating serums of known titre over a polyvalent horse serum for the purpose of distinguishing proved meningococci from these dubious micro-organisms of the nasopharynx.

8. *Carriers.*

Observations made at Caterham and elsewhere have shown that during an outbreak the general carrier rate of a community rises considerably, and that in such circumstances it may be as high among non-contacts as among actual contacts of the cases. Fortunately it would appear that the majority of such carriers become free in a comparatively short time; a minority may continue to harbour the meningococcus for months or even years. Exactly what determines this chronicity is not yet clear. Cleminson's careful observations suggest that malformations may have some influence. What I have felt is that if we only knew the mechanism whereby the temporary carrier becomes free, such information might possibly be useful in application to chronic carriers. In spite of many and varied attempts, no certain means of clearing up chronic carriers has hitherto been arrived at.

9. *The Prevention of Cerebro-spinal Fever.*

Studies during outbreaks of cerebro-spinal fever among troops, which have included the examination of non-contacts as well as contacts, have shown that the serological types present in the nasopharynx of carriers in a given community correspond with those present in the cases. Furthermore, continued observation of the carrier rate maintained for a series of years by Flack and Glover has shown that the carrier rate of a community as determined by sample swabbing is capable of affording a direct index to the imminence or otherwise of an outbreak of cerebro-spinal fever, since an outbreak may be preceded by a rise in the carrier rate. The researches of Glover have also demonstrated the important fact that the meningococcus carrier rate is a direct index to the degree of overcrowding, and that when this is remedied (and facilities for the aërial transfer of droplets reduced) a high carrier rate falls automatically to the normal level. The carrier rate of known meningococci thus forms the most trustworthy index of "the meningococcus pressure" in a community at a given moment. It has been found that the normal carrier rate of 5 per cent. or less may rise during the height of an outbreak to over 60 per cent. For practical purposes a carrier rate of 20 per cent. or over has been regarded as the danger line and calling for active measures.

Bacteriological observations have thus demonstrated the actual manner in which overcrowding operates in promoting outbreaks of cerebro-spinal fever among troops. For this reason, and also because of its success in practice, Dr. Glover's method of spacing out would appear to be the most effective means of checking the spread of this disease. Where overcrowding is unavoidable and "spacing out" impracticable, use has been made of inhaling rooms where the air is kept densely charged with droplets of 2 per cent. zinc sulphate dissolved in normal saline. The atomizing apparatus may be actuated either by steam or by compressed air, and Major Hine has devised a particularly effective jet for producing the requisite degree of atomization. Men are treated in batches, and inhale the spray-laden air through the nose for five minutes daily. Though its effect on the carrier rate of a community is but temporary and the method fails to clear up chronic carriers, the zinc sulphate spray seems from present experience to have a beneficial influence in checking the incidence of cases during an actual outbreak of cerebro-spinal fever. It is advisable not to restrict the treatment to contacts, but to submit the whole community to the inhaling-room treatment whilst an outbreak is in progress.

10. *The Specific Treatment of Cerebro-spinal Fever.*

The mortality among those attacked in the civil and military population respectively between 1914 and 1918 is shown in the accompanying table and chart. The proportion of infants attacked undoubtedly raises the civilian mortality somewhat, but if the average fatality of the disease in civilians between the ages of 20 and 30 over the period in question is compared with the military rate, it is seen that after 1914 a considerable reduction was effected in the mortality among military cases, and that this higher recovery rate was particularly evident in 1918, when the military mortality was 35 per cent. as against 60 per cent. in males of the civil

Incidence and Fatality of Cerebro-spinal Fever among Troops in the United Kingdom, and among the Civilian Population of England and Wales, including London, 1914–18.

Year.	Troops in the United Kingdom.			Civilian Population.					
				All Ages.			Males 20–30.		
	Cases.	Deaths.	Mortality per cent.	Cases.	Deaths.	Mortality per cent.	Cases.	Deaths.	Mortality per cent.
1914	46	30	65.2	300	206	68.7	9	4	44.4
1915	1,199	587	48.8	2,343	1,521	64.9	127	80	63 0
1916	967	430	44.4	1,278	838	65.6	45	23	51.1
1917	1,337	593	44.3	1,385	906	65.4	48	31	64.5
1918	709	252	35.5	715	484	67.6	12	7	58.3
Total ...	4,258	1,892	44.4	6,021	3,955	65.6	241	145	60.1

SUMMARY.—*Military* cases, 4,258; deaths, 1,892; mortality, 44.4 per cent. *Civilian* cases, 6,021; deaths, 3,955; mortality, 65.6 per cent. Total cases, 10,279; deaths, 5,847; mortality, 56.8 per cent.

NOTE.—The military figures are available by permission of the Editor-in-Chief, *Official Medical History of the War*. The civilian figures are taken from reports by Dr. R. J. Reece, C.B., in the *Report of the Medical Officer, Local Government Board*, 1917–18 (Cd. 9,169) and 1918–19 (Cmd. 462).

population between 20 and 30. There can be little doubt that this higher recovery rate among the military was due in great part to improvement in the quality of the therapeutic serum.

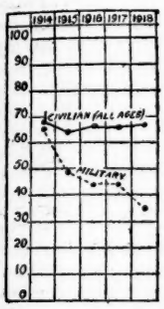

Chart showing fatality of cerebro-spinal fever among troops in the United Kingdom, and among the civilian population of England and Wales, including London, 1914–1918.

The sequence of events with regard to the serum was as follows:

In the early stages of the outbreak the only antimeningococcus serum available for military use gave disappointing results. On investigation it was found that while this serum contained agglutinins for Types III and IV, for which it was active at 1 in 500, it failed at 1 in 50 to agglutinate either Type I or Type II, with which the majority of the patients were infected. With the return of the disease in the following winter a more successful serum was available, but certain batches of it were found to be far more potent clinically than others, and the gross mortality still remained too high. A special research, therefore, was undertaken with a view to obtaining serum of greater potency. As no sure method of standardizing antimeningococcus serum was available, an attempt was made to define the special constituent that determines potency in the case of antimeningococcus serum. The antibody content of a batch of serum that had proved clinically to possess much potency was compared with that of numerous other batches clinically far less efficient. As a result it was found that the index of potency lay neither in the agglutinin content, nor in the complement-fixing antibodies, nor in the opsonin content, since several of the therapeutically inert serums were far richer in these than the serum that had proved to be clinically potent. Comparison was next made of the ability of the potent and other serums to protect mice against a fatal dose of the living meningococcus of each of the two commonest types, but without positive result. Lastly, a comparison was made of the antiendotoxin content of the serums. For preparation of the meningococcus endotoxin a modification of Besredka's method was used, the dried cocci being extracted with distilled water. The procedure used was to mix one minimum lethal dose of endotoxin with 0.5 c.cm. of serum, and after leaving them in contact for half an hour at 37° C. to inject the mixture into a mouse intraperitoneally. As a result the clinically potent serum alone had the power of neutralizing the endotoxin of a representative coccus of Type I and also of Type II; none of the other serums possessed this capacity.

It appeared, therefore, that the clinical potency of the serum was due to its antiendotoxic capacity. The accuracy of this conclusion was now tested by examining samples of some twenty batches of hitherto unused serum in the same way. Only one of these batches exhibited a capacity of neutralizing the endotoxins of both Types I and II in the same manner as the previous serum. This serum was now tried clinically, and found to be as successful as the potent serum previously in use. In one district where the mortality had receded to the neighbourhood of 50 per cent., the application of this serum was followed by a drop in the mortality to less than half that figure.

In order if possible to furnish a supply of antiendotoxic serum the Medical Research Committee provided horses which were prepared at Cambridge by Dr. Stanley Griffith. Each horse was prepared against a single type of the meningococcus, a plurality of strains being used. In view of the work of Besredka and Dopter, these horses were prepared by injecting a fresh suspension of the meningococcus intravenously, precautions being taken to avoid anaphylaxis in the later injections.

Before issue the serum prepared by Dr. Griffith was tested at the central laboratory. It was found to have an agglutination titre for the type coccus as a rule 1 in 4,000 to 1 in 8,000. In view of the previous experience, the serum was not sent for trial therapeutically unless it showed evidence of antiendotoxin. The standardization of the serum by the antiendotoxin method, however, was a somewhat arduous matter owing to the frequent absence of this antibody, and also owing to the fact that the serological types of the meningococcus as defined by the agglutination test are differentiated still further by the antiendotoxin test. This is especially the case with Type II, which Tulloch's researches showed to be complex, and to be divisible into a number of subgroups by agglutinin absorption.

Dr. Griffith's Type I serum was found in the laboratory to possess more antiendotoxin than the serum he was able to prepare against Type II. The clinical results obtained with these monovalent serums have been analysed by Dr. Hine. While the results with Type I serum have been excellent, serums prepared against other types have been less successful.

Before these observations were concluded the opportunity was taken of investigating the valency of meningococcus antiendotoxin, and from preliminary observations it would seem that not only are the various types of meningococcus distinct as regards their respective endotoxins, but also that within the same type—as defined by the agglutinin and agglutinin absorption tests—more than a single endotoxin may obtain. Progress in the serotherapy of cerebro-spinal fever, therefore, would appear to require a more detailed survey of the different types of meningococcus, with a view to defining the degree of this diversity in regard to endotoxin. Information is also needed concerning the production of meningococcus antiendotoxin—an antibody about which at present very little is known, and as a result its preparation is a matter of considerable uncertainty.

Valuable as the presence of antiendotoxin undoubtedly is in antimeningococcus serum, it is more than likely that in the septicaemic form of cerebro-spinal fever another quality—namely, ability to protect against multiplication of the meningococcus—is also desirable. The preparation and standardization of antimeningococcus serum are matters that are now being investigated further by Dr. E. G. Murray on behalf of the Medical Research Council.

A SUMMARY OF THE RESULTS OF THE SERUM TREATMENT OF 267 CASES OF CEREBRO-SPINAL FEVER.

BY

T. G. M. HINE, O.B.E., M.D.Camb.

THE reasons which led to the preparation of monotypical serums for curative purposes having been explained, it now falls to my lot to describe the results attained with these new serums so far as we have been able to ascertain them up to the present time. Many of us here are, perhaps, more interested in the treatment of the disease than in the somewhat academic question of the mechanisms set in motion by the action of this organism. I will therefore shortly give the results which some forty medical officers have been kind enough to send me concerning 267 cases of the disease all treated with the monotypical serum.

These reports, for the most part, were replete with notes showing the severity of each attack, the day of disease on which it was diagnosed, the day on which each dose of serum was given, with its amount, kind, and batch number, the type of organism found, and the quantity and appearance of the cerebro-spinal fluid withdrawn. In the majority of cases fairly full clinical notes were sent giving any special complication and impressions as to the value of any form of treatment. Thus I was able, in a large number of these cases, to form a fairly accurate mental picture of the condition.

A few of these notes, however, as may well be imagined, were rather scanty, for often my informants were not themselves responsible for treatment, and had, perhaps, only once seen the case when they first made the diagnosis. They had then to rely on others for their data. The majority of these reporters were in charge of bacteriological laboratories, and some few of them, by good fortune, were allowed to treat all their cases themselves from start to finish, while others, after diagnosing the case and giving the first dose of serum, never saw the case again.

In the Medical Research Council's Special Report, Series No. 50 (just published, June 3rd), I gave an analysis of these cases, and I now propose to summarize these results so far as possible. Before doing so I should like to recall some of the published mortality figures.

Flexner gives the mortality of non-serum treated cases all over the world in the epidemic of 1904–9 as from 70 to 80 per cent. in some thousands of cases, while Dopter found a 65 per cent. mortality in an outbreak studied by him. Flexner found that in serum-treated cases the mortality was about 31 per cent. in about 1,300 cases, while Dopter gives the mortality of 8.1 per cent. in those properly treated and 27.2 per cent. in cases in which the exhibition of serum was delayed or insufficient, the total mortality being 16.4 per cent. He, however, appears to think that any measures taken after the third day were too long delayed—a rather short period in my view; he collected about 360 cases. Dopter, however, removed from his list, before taking his averages, cases which were moribund when first seen and those which succumbed to other diseases. The first of these rectifications must have considerably lowered his mortality figures, and I do not consider it justifiable, as in my series, of the 11 worst "moribund" cases, 45 per cent. recovered under appropriate treatment. Moreover, about 95 per cent. of his cases appear to be identical with Type I; the importance of this will appear later.

More modern figures referring to the epidemic with which I am now dealing are supplied by the Medical Officer of the Local Government Board for 1914–18. These figures show that among civilians the average mortality in 6,000 cases at all ages was 65.6 per cent., the 1914 figures being 68.7 per cent. and the 1918 being 67.6 per cent. Presumably most of these cases were treated with the best serum the medical men in charge could procure.

Among civilian males between 20 and 30 years of age—ages which compare roughly with those of most of the military cases—the mortality was 60.1 per cent. during the same period—that is, 44.4 (9 cases only), 63.0, 51.1, 64.5, and 58.3. The mortality during the same years among the military cases in the United Kingdom was 65 per cent. in 1914, 49 per cent., 41½ per cent., 44½ per cent., and 35½ per cent., or a diminution of 46 per cent. as between 1914 and 1918.

These military cases include all those treated with *any* serum, with a few not so treated. The mortality in the last year, it is seen, was 35½ per cent. in military cases against 58.3 per cent. in similar cases. In this last year a fair proportion of the military cases were treated with the monotypical serum either alone or combined with other serums, such as the Lister, Flexner's, or Mulford's. The last two were polyvalent serums, while some of the Lister serums were stated to be monotypical, though it was difficult to find any antiendotoxin in many of the samples tested.

Before considering the cases I have collected I wish to point out that the number, 267, is far too small to give really reliable statistical figures, but nevertheless much may be surmised from carefully analysing the material available, and I can only leave it to those present to attach their own values to the facts I shall put before them.

To begin with the 267 cases, 18 of these died of some other disease following on the cerebro-spinal fever; indeed, several of the cases were stated to have been cured of the cerebro-spinal fever before contracting the fatal one. Ten of these 18 cases had influenza and septic pneumonia—a sufficiently fatal combination.

We are thus left with 249 cases of proper cerebro-spinal fever, all diagnosed bacteriologically. In these cases the mortality was 31.72 per cent., or practically the same as Flexner's serum-treated mortality, but not so low as Dopter's figures, though, as already mentioned, these were favourably rectified. Every case reported as having had even one dose of M.R.C. serum has been counted, but some of the cases had several doses of other serum as well, and perhaps only one dose of M.R.C. serum; indeed, in one series of fatal cases it was expressly stated that the M.R.C. serum was kept as a final resort. This hardly gave it a fair chance.

Another consideration then came in, as the object of the analysis was not so much to find what reduction of mortality was caused by using serum, but to elucidate two points. The first was: "Has a serum, known to contain antiendotoxin experimentally, a more favourable action clinically than a serum made with the same organisms but showing by experiment an absence of antiendotoxin?" and the second question was: "Is the antiendotoxin specific with regard to the type of coccus?" So far as statistics founded on such a relatively small number of cases can afford an answer to such questions, the answer to the first problem is definitely "Yes," and the answer to the second is also probably an affirmative.

Now, to ask these questions effectively it is obvious that the type of invading coccus must be definitely known, and of the 249 cases it was found that in 48 the type was never clearly determined, or that it was found too late to be of any value in treatment. I may add that the death rate in this group rose to 45.83 per cent., 31 of them being severe cases with 20 deaths, or a mortality of 64.5 per cent. As we are only concerned with cases which receive the appropriate serum we may discard these 48 cases, which leave us with 201 cases having 57 deaths—a mortality of 28.36 per cent.

If now we divide these 201 cases into two groups—(*a*) cases in which treatment started before the sixth day (not Dopter's third day) and the serum was given in adequate amount, and (*b*) those in which serum was first given after the sixth day or insufficiently and cases moribund when first seen—we find that the first group contains 141 cases with 27 deaths—that is, mortality = 19.14 per cent., and the second group has 60 cases with 30 deaths—that is, mortality = 50 per cent.

These figures lead to my first conclusion—that the serum must be administered reasonably promptly to be of value. This will not occasion surprise, for the same is known to apply to other serum-treated diseases.

If the figures of the cures according to the day of the disease on which serum was first given be examined, it will be seen that the mortality is about the same till after the sixth day, when it rises quickly—that is, before the sixth day 25 per cent., and after the sixth day 43 per cent. These figures are slightly different from those given above, as all the cases, including those moribund and insufficiently dosed, are counted and not placed in two groups.

The next point to which I wish to draw attention, and one, in my view, of the greatest importance, is the type of coccus causing the disease in each case.

Of the 201 cases which were satisfactorily and completely tested bacteriologically:

65	were	Type I	with mortality	= 9.23 per cent.
104	,,	Type II	,, ,,	= 39.42 ,,
28	,,	Type III	,, ,,	= 25.00 ,,
4	,,	Type IV	,, ,,	= 75.00 ,,

while of 48 cases tested too late or not at all the mortality was 45.8 per cent. Dopter's death rate of 8.1 per cent.

approximates to the 9.23 per cent. of the Type I figures just given, and there is evidence to prove that the 95 per cent. of his cases spoken of before were identical with our Type I, though at that time the meningococcus had not been divided into four types.

The Types I and III figures have the lowest death rate, but frequently Type III was late in being proved, and therefore did not always get the appropriate serum at once. When these cases eventually received Type III serum there was frequently a marked improvement, and often a cure of an apparently hopeless case.

It is perhaps as well to explain here that besides the four type serums a pooled I and II serum was issued which was to be given at the start to avoid waste of time while the tests were being made. As 80 per cent. or more of the cases were either Types I or II this method generally helped, but on the rarer occasions when a III or IV were at work the pooled serum seemed to be of little value. These observations and similar experiences with Types I and II cases, in which any improvement was only slight until the full dose of the true monotypical serum became available, led me to make my previous statement that the antiendotoxin is probably specific for the type of coccus. Dr. Gordon has proved this, experimentally, almost certainly, and the clinical evidence is strongly corroborative.

It will be remembered that I said one object of the analysis was to answer the question, "Has a serum, known to contain antiendotoxin experimentally, a more favourable action clinically than a serum made with the same organism but showing by experiment an absence of antiendotoxin?" and that, in my view, the answer was "Yes." The evidence on which my opinion is based is contained in the reports on these cases, and it is quite clear that the serum containing the greatest amount of antiendotoxin experimentally gave a far better result than that in which it was absent or much reduced—that is, the clinical results accurately paralleled the experimental work. In no case, for instance, which was more severe than a very mild attack was either a Type I or II serum found to benefit a Type III case, which only began to improve when it received the proper Type III serum. I find myself, therefore, in complete agreement with Dr. Arkwright's statement:

> If it were proved that a knowledge of the subgroups were of value for the production of the therapeutic serum, or for any such specific purpose, then this classification would become immediately of great importance.

It would obviously be impossible to give the appropriate monotypical serum unless the type of coccus can first be determined, as, in the present state of our knowledge, we are not able to make a combined serum containing effective doses for all types.

My second conclusion is, therefore, that it is of the utmost importance for proper treatment to ascertain the type of coccus at the earliest moment possible, as therein lies the only chance of applying curative serum scientifically. The pooled serum device was an attempt to save time until the bacteriological examination was complete, as it combined, though in small doses, the two antiserums which would be useful in about 80 per cent. of the cases. With our present difficulties in making a serum containing antiendotoxin of sufficient strength, it is obvious that to attempt to pool all four serums, either for preliminary use or for routine treatment throughout, is to court failure, for the capacity of the theca is limited, and with the serums diluting each other 1 in 4 the dose of the right kind would be inadequate.

In looking at the figures of typed cases just quoted, it will be seen that though the mortality for Type I, which formerly provided the greatest number of serious cases, has been reduced to under 10 per cent., the Type II cases still showed a mortality of nearly 40 per cent. This was unfortunate, but did not surprise us; it merely bore out the experimental evidence, which proved that the Type II serum, despite the great efforts Dr. Griffith made to produce as good a serum as his Type I, contained by no means the same proportion of antiendotoxin.

The great success of the Type I serum, for such it undoubtedly was, spurred on all to produce an equally good Type II. Once now and again a sample was obtained of nearly equal merit to the other, but the conditions for successful production have not yet been defined, and the few good results cannot with any certainty be repeated as they can be in the Type I serum. Had this been attained the total mortality of 28.36 per cent. would have been greatly lowered, for we find the Type II mortality of 39.4 per cent. is offset by a mortality of 16.5 per cent. for all the other types added together.

A third conclusion I wish to draw is one very difficult to prove by figures. It is the importance of giving the serum in adequate quantities and resolutely sticking to the treatment. It was laid down as a direction early in the epidemic that serum should be given not only as early as possible but repeated daily for at least four days after treatment had commenced, whether the patient was better or not. Those that followed this direction seemed to have the greatest success, but unfortunately there were more than a few instances in which, after great improvement following the second or third dose, the clinician determined to pause and watch progress, often with the result that in a few days a relapse occurred—sometimes of a fatal nature. One cannot avoid speculating on the probability of the patient being free from relapse had this simple direction, founded on experience, been more carefully followed.

THE MENINGOCOCCUS "CARRIER" QUESTION.

BY

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I PROPOSE to deal shortly with the questions arising in Dr. Arkwright's fifth conclusion. He states:

> The contacts and "non-contacts" who carry the meningococcus in the nasopharynx during an epidemic are so numerous that it is neither necessary nor desirable to attempt isolation of carriers. It is very probable that even when cases of meningitis first appear at the beginning of an epidemic the number of carriers is often too high to make an isolation policy possible, but the data for forming an opinion on this point are not very numerous.

With this conclusion I am in complete agreement. It is, however, still the practice of many bacteriologists engaged on public health work to attempt to isolate carriers when a case of the disease occurs, and as such work necessitates much labour and time which I believe could be spent more profitably, I would suggest that a definite expression of opinion would be of value to those of us who, owing to official suggestions in the past, are still asked to examine contacts in connexion with cases of this disease.

The work which I will briefly describe deals with this question and, I think, confirms Dr. Arkwright's point of view very strongly.

In 1916 I was asked by Dr. Newsholme to investigate the question of the extent to which meningococcus carriers could be found in a normal non-contact population. Accordingly, working on the lines recommended by Drs. Eastwood, Scott, and Griffith, I came to Cambridge and proceeded to examine the bacteriology of the nasopharynx of people who had not come in contact with a case of meningitis.

It is unnecessary to go deeply into the methods employed. Kutscher's media, which I believe to be more valuable than any other for getting growth of meningococci, was used in the primary culture. The sugar media were prepared according to Linglesheim's formula and agglutination tests carried out on orthodox lines. The methods are fully described in my report to the Local Government Board.

Though the results in all classes of people living under different conditions are comparable, I propose to confine myself to one clean-cut section of the population tested, because I think the most useful lesson can be drawn from this set of experiments.

At Cambridge in 1916 two cases of cerebro-spinal fever had been notified—one in a girl aged 6 and the other in a girl aged 13, both in the month of March. In October, seven months after the last case, I swabbed the nasopharynx of most of the staff and employees at the Cambridge Scientific Instrument Company's works outside the town. It should be noted that these employees were earning good salaries and wages and therefore lived in comfortable homes; that none of them had come in contact, to his knowledge, with a case of cerebro-spinal fever; that for seven months in a town of about 40,000 population there had been no cerebro-spinal fever; and that most of the employees had lived and worked there for many months. I think it will be agreed that this may be described as a "non-contact" population so far as such could be found.

Let me now state the results obtained.

Of the 100 employees swabbed, 41 yielded colonies on Kutscher's medium indistinguishable from meningococcus; in 28 plates such organisms were present either in almost

pure cultures or in large proportions. From these plates, 38 of the meningococcus-like organisms gave sugar reactions of meningococcus and good agglutination (generally with serum 1 in 400 or 1 in 800) with one of the monovalent antimeningococcal serums employed. Thus 38 per cent. of the employees, by cultural and agglutination tests, would have been classified as meningococcus carriers if a case had occurred in the works. Further, absorption tests, following as closely as possible the technique recommended by Gordon, were carried out on 19 strains of the above 38 agglutinating strains; of these, 9 absorbed the agglutinin as well as the homologous coccus, and 4 absorbed it partially. Presumably, therefore, 26 per cent. of these employees who had not been in contact with cerebro-spinal fever were harbouring organisms in their throat which were indistinguishable by every test known from the true meningococcus.

Thus, working with the best possible media under ideal conditions, I was able to detect a much larger proportion of carriers where there had been *no case* of cerebro-spinal fever than most observers, working under more difficult conditions, generally obtain amongst *actual* contacts. Is this result not sufficient to show that the finding of a few positive contacts in the usual circumstances has no meaning, and their isolation consequently no value?

It has been suggested that only those contacts found harbouring the same type of meningococcus need be isolated. But if a large proportion of the general population harbours, as I have found, the common types, it follows that they will still be considered dangerous unless one of the rarer types is the one cultivated from the patient with whom they have been in contact.

THE MENINGOCOCCUS CARRIER RATE: ITS RELATION TO PROPHYLAXIS AGAINST CEREBRO-SPINAL FEVER.

BY

J. ALISON GLOVER, O.B.E., M.D., D.P.H.

BEFORE we can deal rationally with prophylaxis against any disease we must know the chief etiological factors which tend to produce outbreaks of that disease. In the case of cerebro-spinal fever we believe these factors to include—

1. The advent of virulent epidemic strains of the meningococcus, either by importation, or by indigenous strains becoming virulent by some process of exaltation, such indeed as might be produced by the rapid transmission from temporary carrier to temporary carrier, which is implied by the existence of a high carrier rate in an overcrowded community.
2. Season: in Europe, the first quarter or four months of the year.
3. Severe weather, particularly sudden variation, snow, east winds, and unusual cold.
4. Antecedent catarrhal epidemics, particularly influenza.
5. Causes temporarily lowering resistance, such as fatigue, strenuous training, antityphoid inoculation, nostalgia, and new entry into the infected community.
6. Aggregation of susceptibles, such as occurs in recruiting dépôts.
7. A high carrier rate of epidemic strains of the meningococcus in the population at risk.
8. Overcrowding.

The Relation of Carrier Rate to Overcrowding.

This relationship is extremely close. Extensive examinations amongst the troops in the London Command appear to show that, were it not for differences in the efficiency of ventilation, and for differences due to catarrhal diseases, which increase the spraying range of the individual, the relation between the distance separating the beds and the carrier rate of a unit would be almost an inverse ratio.

The chief thing to remember is that efficient ventilation and distance between the beds are the vital points; mere floor space and mere cubic space are not at all of the same importance.

It was noted also that if overcrowding occurred in a unit which had not previously been overcrowded two things happened: First, a marked rise in the carrier rate occurred, usually within a fortnight, reaching its maximum about three weeks after the overcrowding began—this is termed the "warning rise"; and secondly, when the other factors which have been enumerated were present, and the carrier rate reached 20 per cent., cases of the disease usually began to occur.

In nearly every case the carrier rate of non-contacts of the same unit was approximately equal to the carrier rate of the actual contacts of the case.

Rise in Non-contact Carrier Rate a Storm Signal.

A sharp rise in the non-contact carrier rate to over 20 per cent. is as sure a storm signal of imminent trouble as it is a sign of overcrowding or dangerously deficient ventilation. The same phenomenon is probably to be found in most epidemics of cerebro-spinal fever. Thus Olitsky, during the Hong Kong epidemic, took a large non-contact sample of inmates of the prison (in which no cases had occurred) and found a carrier rate of 25 per cent.

Carrier rates of 70 per cent. were found in two English camps in 1917, contemporary with sharp outbursts, and carrier rates of over 50 per cent. have been found in troops recently landed from crowded transports, and cases have developed just after disembarkation, usually fourteen to twenty-one days after the commencement of the severe overcrowding.

The rise of the carrier rate wave is greatly accelerated and heightened by the coexistence of catarrhal troubles, particularly influenza.

The accompanying diagram (Fig. 1) shows the influence of overcrowding upon the carrier rates, the "warning rise" to a 20 per cent. danger line being followed within a week by cases of the disease. It also shows that overcrowding has a more pronounced effect than season or temperature.

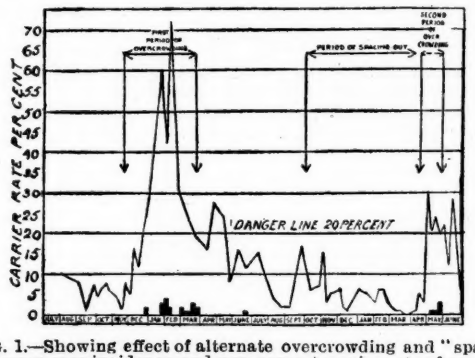

FIG. 1.—Showing effect of alternate overcrowding and "spacing out" upon case incidence and non-contact carrier rate of cerebro-spinal fever at X Dépôt. Line = weekly carrier rate. Columns = weekly incidence of cases.

The low carrier rates at the end of the "spaced out" period correspond with the height of the danger season, and were contemporary with a sharp outbreak at another dépôt ten miles away, the latter being severely overcrowded.

We may therefore divide our measures of prophylaxis into—

1. Measures designed to sustain the natural resistance, particularly during the stage of new entry.
2. Measures designed to diminish mass infection—that is, to lower the carrier rate of the community.
3. Measures designed to increase the natural immunity—that is, vaccines.

1. *Measures Designed to Sustain the Natural Resistance.*

These consist of efforts to tide the new recruit over his first one or two months of service. During the danger season for cerebro-spinal fever especially, the new recruit should have his antityphoid inoculation postponed until he is somewhat acclimatized—that is, until his second month. During the danger season training also should be more gradual, parades before breakfast forbidden, and all cases of catarrh with pyrexia admitted to hospital and isolated. Recruits are very frequently the most crowded section of the military community, whereas it is of the highest importance that they, above all, should be especially protected by "spacing out."

2. *Measures to Diminish Mass Infection (that is, to Decrease the Carrier Rate).*

A. The prevention of overcrowding and the provision of adequate ventilation are by far the most important of these; the space between the beds is of supreme importance.

The diminution in the carrier rate of four units, quartered in barrack rooms, who, at the first examination, were severely overcrowded (the beds being about 9 in. apart), and who were re-examined six weeks later (the beds during the interval having been rigidly 2½ ft. apart), is shown in Fig. 2, the ventilation being simultaneously much improved by simple devices.

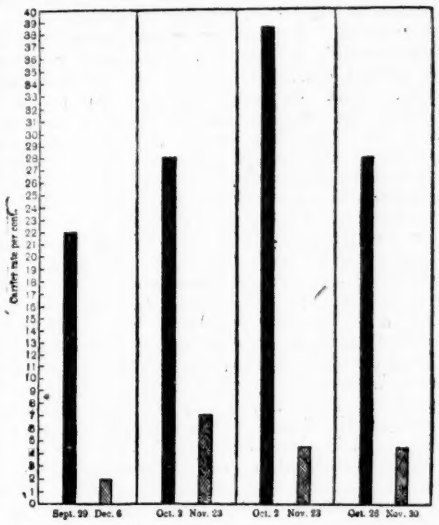

FIG. 2.—Effect of "spacing out" barrack rooms. Showing carrier rate per cent. before "spacing out"—black columns, and after "spacing out"—shaded columns.

The restoration in the British Army of the peace standard of 3 ft. between beds, 600 cubic feet and 60 square feet of floor space, with adequate ventilation, will probably prove almost an absolute preventive of an outbreak, though sporadic cases may occur.

The efficacy of emergency methods of improving ventilation was dramatically exemplified by Captain J. H. R. Yardley, D.S.O., in the Sudanese expedition to East Africa in 1917. An outbreak of cerebro-spinal fever occurring in the force, Captain Yardley had the walls of the huts removed and the men were left under roofs only. No case occurred in his company. It has been found, too, in Egypt that when native units were suffering from an epidemic whilst in barracks, transference to tents with permanently rolled up "flies" promptly arrested the epidemic. Unfortunately such methods are scarcely feasible during the danger season in England.

B. Treatment of the whole community by naso-pharyngeal disinfection. This is best done by treatment in a spray chamber with Hine's spray jets, supplied by steam from an exterior boiler, and using 1.5 to 2 per cent. zinc sulphate solution as a disinfectant.

Each jet suffices for 1,500 cubic ft. of chamber, sprays 80 c.cm. of disinfectant solution a minute, and works best at about 45 lb. of steam pressure.

Each member of the community should receive ten minutes' vigorous inhalation treatment every day for one week.

The Levick spray is useful for small numbers. Great difference of opinion exists as to the efficacy of this treatment.

It appears inferior to the hygienic measures of improving ventilation and spacing out (as indeed cure must always come second best to prevention), but it may be of great utility when (as on a crowded transport) hygienic conditions are bad, or when, as in a fortress, spacing out may be impossible. In certain outbreaks it certainly did appear to prevent the occurrence of fresh cases.

I did many experiments swabbing men before and after treatment, but without any convincing results. This method has little effect upon the chronic carrier. Its efficacy is probably due either to the community being less heavily infected after treatment or to some astringent action of the zinc sulphate upon the mucous membrane. I have tried a good many other preparations, but for steam spray treatment I prefer zinc sulphate to any other preparation.

C. Search for carriers. The elimination of all carriers by examination and isolation may be taken as impracticable, if only on account of their liability to relapse into carrying after "cure." If attempted it should be done very early, before the carrier rate has had time to rise.

In view of the fact that in a community in which an outbreak of cerebro-spinal fever is in progress, "non-contact" carrier rates will usually be found equal to "contact" carrier rates, the isolation of proved carriers who have been in close contact with cases would also appear somewhat illogical save for one important consideration.

This is that the isolation of such contacts proved positive will probably include the isolation of the actual carrier who infected the patient—that is, the actual source of the strain which has proved its virulence—and it will also include all those most likely, by close contact with him or with the patient, to have been infected with this strain of proved virulence.

The examination of persons who have been in prolonged and intimate contact with actual cases (particularly those contacts before the onset) may therefore be considered as a desirable prophylactic measure, and the isolation of such of them as may be proved carriers to be also desirable.

3. *Prophylactic Vaccination.*

Prophylactic vaccination against cerebro-spinal fever has been tried on a moderately large scale in at least two epidemics in England. At Salisbury in 1915 it appeared to give promising results (Greenwood), 4,000 persons being inoculated, none of whom developed the disease. During another outbreak, at which it was being tested, two men developed fulminating attacks of the disease on the day of inoculation, and although this may have been purely coincidence, the procedure was abandoned.

Gates gives the results of the prophylactic vaccination of 3,700 volunteers at Camp Funston in 1918. Three injections respectively of 2,000 million, 4,000 million, and 4,000 or 8,000 million cocci were given at weekly intervals. Three of the vaccinated developed the disease, one after one injection, one after two, and one nine weeks after his third injection (4,000 million). The incidence of the disease upon the vaccinated and upon the unvaccinated is not compared.

The value of the procedure cannot yet be said to be proven; but if a systemic invasion precedes spinal infection, it appears logical to build up antibodies in the blood stream as a second line of defence. Moreover, a large percentage of vaccinated men were proved by agglutination tests (Gates) to possess agglutinins of varying titre corresponding to those found in chronic carriers, who, it is generally agreed, possess some immunity to the disease.

In view of experience, however, it would appear highly advisable, wherever possible, to perform the vaccinations before the commencement of the danger season and not at the height of the epidemic. Instances of inoculation during the incubation period of the disease such as we have mentioned are likely to bring the procedure into disrepute should they occur. Personally I have had no experience with prophylactic vaccination against cerebro-spinal fever.

Had time permitted I should like to have described briefly the work at Caterham Dépôt. Here observation upon the non-contact carrier rate was kept for three years, weekly samples of 100 men being examined, first by Captain Martin Flack and then by myself. In all there were four outbreaks of cerebro-spinal fever at the dépôt, two occurring during the period of observation. In both cases the "warning rise" of the carrier rate was marked. However, time will not permit more than a reference; full details of this work will be found in the final report of the Medical Research Council on Cerebro-spinal Fever when it is published.

In conclusion, I should like to remind you once more of three things:

1. A high carrier rate is a storm warning of the danger of an outbreak of cases. In other words, an outbreak of cerebro-spinal fever consists of two parts; there is the carrier epidemic, which precedes and accompanies the case epidemic. If we can by examination detect the carrier epidemic we may abort or altogether prevent the case epidemic.
2. A high carrier rate usually denotes severe overcrowding somewhere, probably in the sleeping quarters of the community infected.
3. In the same community and under the same conditions non-contact carrier rates approximate to contact carrier rates.

Summarizing the points of prophylaxis against cerebro-spinal fever it may be said that—

1. The prevention of overcrowding is of paramount importance.
2. Ventilation and distance between beds are of much greater importance than mere floor or cubic space. Wall space is essential.
3. The early isolation of cases of catarrhal disorder is of great importance in preventing the increase of the carrier rate. From one point of view it is almost of more importance to isolate a coryza patient who is not a carrier, than a carrier who

has not a catarrh. The former can spray the carrier at four or five feet, and if the carrier succumb to the coryza, he in his turn will spray the meningococcus with his catarrhal sneeze to a like distance.

4. In exceptional circumstances steam spray treatment may be of great assistance. The peace standard of the British army of 3 feet between beds, 60 sq. feet of floor space and 600 cubic feet, is adequate, and will probably render other prophylactic measures unnecessary.

PATHS OF INFECTION.

BY

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OTHERS have dealt with the now well-recognized fact of the presence of meningococci in the nasopharynx and its neighbourhood, and recently Embleton has especially discussed the relationship of the occurrence of sphenoidal empyema in epidemic cerebro-spinal fever. My own observations in the *post-mortem* examination of over a hundred fatal cases led me to believe that the spread to the meninges is not, as some have believed, by way of the perineural arachnoid prolongations round the olfactory nerves where these pass through the cribriform plate of the ethmoid, nor by direct inflammatory extension through the pituitary fossa or elsewhere; but the pathological anatomy of at all events this series of *fatal* cases appears rather to suggest that there is a ventricular infection *before* the meninges are affected, and that the infection reaches the choroids by way of the blood stream. The organism may reach the latter either by way of the lymphatics or smaller blood vessels, and may perhaps be determined by the occurrence of some such phenomenon as sphenoidal sinus suppuration, or in some other way. Its actual presence in the blood early in the disease is, of course, now well recognized. The problem of how the meningococcus reaches the meninges has been of especial interest to me.

From the *post-mortem* examination of over a hundred fatal cases of cerebro-spinal meningitis occurring mostly during the war, I find that the ventricular system is the site of acute inflammatory changes—often as marked as in the meninges, or not infrequently even more so. Turbid fluid containing large numbers of inflammatory cells was present in every case, in varying amount according to the degree of acute inflammatory hydrocephalus. There was usually a copious deposit of somewhat soft fibrino-purulent material upon the ventricular walls, especially in the more dependent parts, such as the horns of the lateral ventricles and in the third ventricle and infundibulum, the latter as well as the former cavities usually showing a varying degree of distension. The ependymal lining of the whole chain of ventricles showed swelling, and there was usually softening of the neighbouring brain tissue—an acute encephalitis, often with haemorrhages, generally small or petechial, but not infrequently considerable in size, and sometimes very extensive, ploughing up the cerebral substance, and in some cases bursting into the ventricles and extending down into the membranes of the cord, and diagnosed during life by lumbar puncture. Periventricular encephalitis appears to be one of the most important factors leading to a fatal issue, especially where it involves the structures in the floor of the fourth ventricle. From my examination of this series I am of opinion that, in these fatal cases at all events, although it is difficult by *post-mortem* evidence alone to be certain of the direction of spread, the infection of the ventricles had usually preceded that of the meninges, the organisms having been carried to the choroids by the blood stream from the nasopharynx or its neighbourhood, and setting up an endoventriculitis or ependymitis. In very acute cases with a rapidly fatal issue, the ventricular inflammation was usually more obvious than that of the meninges, which sometimes showed no naked-eye changes beyond acute congestion.

In practically all cases meningococci were more numerous in the ventricular than in the spinal fluid, and were sometimes present in large numbers in the former in cases where they could not be detected in the lumbar puncture fluid. From the ventricles the infection appears to spread to the surface of the brain, especially at three points—namely, (1) through the thinned and inflamed floor of the third ventricle and infundibulum, and so comes to be specially abundant in the cisterna basalis round the pituitary stalk, from the optic commissure in front to the crura and pons posteriorly; (2) through the pial roof of the fourth ventricle and its foramina to the surface of the medulla and under aspect of the cerebellum, etc.; and (3) backwards through the great transverse fissure to the central lobe and culmen of the cerebellum and the neighbouring parts, and sometimes through the valve of Vieussens or superior medullary velum. The surface exudate is usually found especially over these three areas, from which it may then spread and coalesce, giving the typical "basal" or rather "post-basal" distribution, and from which it spreads down the cord and to a varying extent over the surface of the cerebellum and cerebrum. The exudate appears to be very much less liable to spread forwards over the cribriform plates of the ethmoid, round the olfactory tracts and bulbs—a point which appears to militate against the view, put forward by some, that the infection spreads to the brain through the roof of the nose and cribriform plate. In three cases in which the ventricles were tapped during life, the ventricular fluid was found to contain more inflammatory cells and meningococci than the lumbar puncture fluid—in two of these, and in a number of the *post-mortem* cases, the organisms were so numerous as to resemble a "cultural" growth. In some cases this ventricular infection persists after the surface condition has cleared up under serum treatment, and may lead to a fatal issue, although the cord may be found "clean" at the necropsy. In other cases which have cleared up, but in which the foramina in the pial roof of the fourth ventricle have become blocked, a non-inflammatory or retention hydrocephalus may ultimately supervene and cause death. Another phenomenon which aids mechanically in the production of hydrocephalus is the pushing down of the medulla and the adjacent portion of the cerebellum into the foramen magnum, compressing the foramina in the pial roof of the fourth ventricle, and preventing the egress of fluid even when these foramina are not blocked by exudate. Such driving down of these structures into the foramen magnum, like a cork into the neck of a bottle, may be produced both by the congestion and swelling of the whole brain and by the accumulation of fluid in the ventricles—that is, this condition and the hydrocephalus, however produced, aggravate one another.

DIPLOCOCCUS CRASSUS AND MENINGITIS.

BY

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MEDICAL literature supplies but few recorded cases of meningitis in which infection is attributed to or associated with the presence of *Diplococcus crassus*—a Gram-positive organism, first reported by Jäger[1] in 1895, during an epidemic of cerebro-spinal meningitis.

[Dr. Graham Forbes gave a detailed history of the organism and a complete account of the literature relating to it from the time of its discovery to the present day.]

Morphologically the diplococcus is stated to be a little larger than the meningococcus, and is always Gram-positive; culturally it grows readily at 20° C., slowly on gelatin at first, but later yields abundant colonies which are smaller than the meningococcus, grey to the naked eye, brownish under the microscope, and without producing any liquefaction. It ferments glucose, maltose, levulose, saccharose, and lactose. Macé[2] quotes it as being constantly agglutinated by antimeningococcal serum even up to 1 in 200 dilution, and states that this property, due to the presence of secondary group agglutinins, is lowered by the age of the culture.

On the other hand, the meningococcus was never agglutinated by anti-crassus serum, and complement reaction tests proved negative. He also alludes to the marked resistance of the organism, which retains its vitality and virulence for a considerable period. G. Rosenthal[3] has quite recently (1918) described a case of cerebro-spinal meningitis in which lumbar punctures yielded turbid specimens of fluid, rich in polynuclear cells, containing albumin, and usually giving the sugar reaction with Fehling's fluid. Direct preparations rarely showed intra- and extra-cellular diplococci, and cultures yielded *Meningococcus crassus* de Jäger. Cure was claimed to have been effected by intrathecal injections of solutions of chloride and citrate of soda, 7 and 8 grams respectively per litre.

Examination of the cerebro-spinal fluid in a case of

meningitis, following on fracture of the base of the skull, resulted in the isolation of two strains of cocci, one of which may be regarded as conforming with *Diplococcus crassus* in its morphological and cultural characters:

A workman (W. B. C.), aged 50, employed in furniture removal, on January 8th was handling a heavy article and fell, striking the right side of his head. Blood is said to have spurted from the right ear at the time. He was taken to the neighbouring cottage hospital, where fracture of the skull base was diagnosed, but as the patient became maniacal he had to be transferred to the infirmary. There he made fair progress, and four weeks after the accident returned at his own request to his home in London, travelling by train and tram. His mental condition was described as rational but dull, and not quite normal. He made no attempt to return to work, but was feeling well enough to take walks. He complained of headaches from the time of his return home, and on March 20th they had increased so much in severity that he was obliged to take to his bed a day or two later. He was admitted to the local borough infirmary on March 27th in a state of subcoma. It was said that there had been no convulsions, and there was no evidence of paralysis and no optic neuritis.

Lumbar puncture on March 30th yielded about 10 c.cm. of apparently clear colourless fluid, which was forwarded the same day to the pathological laboratory of the London County Council and examined within four hours of collection.

Chemical examination showed the presence of albumin in considerable quantity, amounting to 0.07 per cent. by Aufrecht's albuminometer. Fehling's solution was readily reduced. There was no clot formation on standing. Centrifugalization yielded a visibly turbid deposit from which film preparations were made and stained by Jenner's stain, by Gram's method and for tubercle bacilli. Small quadrilateral crystals of cholesterin were present in fair numbers, together with leucocytes considerably in excess of the normal, the majority being lymphocytes (79 per cent.), degenerated endothelial cells (12 per cent.), and polymorphs (8 per cent.), and red corpuscles. A few scattered diplococci, definitely Gram-positive and not intracellular, were readily seen without any prolonged search. Careful search failed to show any tubercle bacilli.

Cultural Examination.—Five drops of the fluid were inoculated on to the surface of a plate of Gordon's medium. After twenty-four hours' incubation at 37° C., the area occupied by each drop yielded a collection of discrete round colonies, which under the hand lens were seen to be composed of two types—one, raised dense white with sharply defined edge about 2 mm. in diameter (Type II), and the other (Type I) somewhat smaller, opalescent with fading margins. Subcultures were made on to ordinary agar-agar slopes from each of the two types of colonies. Film preparations showed Type I to be composed of a small Gram-positive coccus measuring 0.6 μ to 0.8 μ, showing no characteristic grouping; and it was regarded as a staphylococcus and a possible contamination. Type II, also strongly Gram-positive, consisted of a large rounded diplococcus measuring 1 μ to 1.2 μ, with the opposing surfaces of each half in close apposition; its appearance suggested a resemblance to *Diplococcus crassus*. At this stage no particulars had been provided as to the past history of the case. The result of examination of the fluid was reported to the infirmary, and a tentative opinion expressed in favour of a chronic meningitis, type indeterminate.

The further course of the case was of brief duration. The patient died, without regaining consciousness, on April 1st, just twelve weeks after the accident. *Post-mortem* examination was performed the following day at the infirmary, and revealed:

1. Clear evidence of a still unhealed fracture at the middle fossa of the skull base on the right side.
2. A diffuse chronic leptomeningitis, shown by thickening and opacity of the membranes. There was no purulent exudate and no evidence of tubercle.
3. Well marked hydrocephalus affecting the lateral third and fourth ventricles as the result of obstruction to the foramen of Majendie by the chronic leptomeningitis.

[Dr. Graham Forbes gave particulars of further cultural tests which confirmed the diagnosis of the Type II organism as *Diplococcus crassus*. Animal inoculation experiments were being undertaken. Agglutination against antimeningococcal serums gave negative results.]

Remarks.

1. Meningitis, following on fractures of the middle fossa of the skull base which do not prove rapidly fatal, is regarded as one of the serious infective complications most likely to occur. Trotter[4] states, however, that the graver forms of meningitis are an uncommon event in fractures of the skull base, but there is reason to suppose that minor grades of meningeal infection occur frequently and are recovered from.

2. The changes found in the cerebro-spinal fluid in the case of the patient (W. B. C.) pointed, in the absence of any history, to a chronic form of meningitis, particularly the character of the cell deposit, largely composed of lymphocytes. Although open to question on the score of possible contamination, the discovery of Gram-positive cocci in direct film preparations from the cell deposit within four hours of withdrawal of the fluid, and the subsequent appearance in culture of the two strains of cocci described, seem to justify the conclusion that these organisms, originally saprophytic and of low virulence, gained access directly from the external auditory meatus to the cerebral membranes. The severity of the damage to the tissues at the seat of injury may be regarded as having been productive of a lowering of local resistance sufficient to enable the invading saprophytes to acquire necessary virulence and pathogenicity, and thus become responsible for a chronic leptomeningitis. It is possible also that the recovery of such saprophytic organisms—notably *Diplococcus crassus* — from recorded cases of cerebro-spinal meningitis may be due to primary or secondary invasion of the meninges from the nasopharynx or auditory meatus.

3. Confusion as to the identity of the organism first described by Jäger and Heubner[5] prevails in the original and later accounts given by Lingelsheim[6] and Stoevesandt[7] of the *Diplococcus crassus*. Particularly is this the case with reference to its quite unexpected behaviour and reported response to agglutination by antimeningococcal serum, the correctness and accuracy of which one can but doubt in the face of up-to-date and more exact observations in agglutination phenomena. Better definition is, however, derived from the more recent descriptions of Harvier[8] and Macé, although the latter in his account still quotes Lingelsheim's positive agglutination results as a feature of *Diplococcus crassus*.

4. The two strains of cocci isolated from the cerebro-spinal fluid of the case here reported—No. 1, apparently *Staphylococcus albus*, and No. 2, suggested as *Diplococcus crassus*—conform in many respects to those obtained by Stoevesandt in association with his two cases of meningitis. Closer confirmation of the identity of No. 2 is provided by the account of the case given by Harvier, whose description of the morphological and cultural characters and negative response to agglutination of the organism he isolated as *Diplococcus crassus* closely agrees with the behaviour of the diplococcus I now bring to your notice.

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DISCUSSION.

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THE opening paper of Dr. Arkwright and those of subsequent speakers who have contributed to our knowledge of the meningococcus during the war contain such a wealth of experimental data as to render it extremely difficult even for the trained bacteriologist to adjudicate between the bacteriological points still at issue and for the hygienist to decide on the bearing of the findings on the control of epidemics in practice. It is with the hygienist and administrator that I am most in sympathy in this question, as during the war I had occasion to advise with regard to control measures both in Egypt and Mesopotamia, and was consequently compelled to look at the problem from two standpoints. I left this country for the East entertaining the belief, then widely held, and supposed to be well founded, that among the non-contact community meningococcal carriers were exceedingly rare; that at the commencement of an outbreak carriers among the affected population were also few; and that therefore, if carriers were thoroughly searched for and isolated, or treated when discovered, much good might be done in arresting the spread of the epidemic. I very soon found that in the first place an organization necessary to cope efficiently with the bacteriological side of the question was absolutely impracticable, and that the retention of contacts was an irksome affair to the unfortunate persons held up, and a decided nuisance to the military authorities responsible for maintaining the fullest possible complement of men. The result was a compromise based simply on

common sense—namely, the avoidance of overcrowding in tents and billets, and certain other minor recommendations. All the time, however, I was deeply interested to ascertain what was happening at home, and one heard of the elaborate bacteriological organization at work in England, and the recommendations emerging therefrom. What was possible in England in this way was certainly not possible among operating troops on the Eastern fronts; and it is somewhat curious that one has heard little or nothing of what was carried out or attempted in this connexion on the Western front. Now, what after all have we learnt from this work at home which is of value to the hygienist? We have learnt—and I know this is the chief issue—that overcrowding has a definite influence on the carrier rate, and that therefore the common-sense procedure of "spacing out" is justified bacteriologically. On the other hand, I am not satisfied that any real evidence is available proving that the hunting for and isolation of carriers has had any significant effect in stemming the tide of an epidemic. The treatment of discovered carriers might be advised if it were to hasten the disappearance of the organisms from the throat; but it would appear, I think, from the work carried out on this question that for the temporary carrier no treatment tried is materially superior to Nature, and that the chronic carriers are little, if at all, influenced by treatment. I cannot see how Colonel Gordon's recommendation to submit the whole community to the sterilizing influence of the inhalation room during epidemics can be seriously entertained. Why is it now suggested that the whole community should enter the inhalation chamber? It is, I imagine, because of the discovery that a fairly considerable percentage of carriers exists among non-contacts. We require, I think, yet to have data with respect to non-contacts investigated at a time when cerebro-spinal meningitis has entirely ceased to be epidemic, but at present we have abundant data from the Ministry of Health bacteriologists which, allowing for some difference of opinion with regard to the serological grouping and epidemiological importance of certain nasopharyngeal strains, must profoundly affect our previous notions that the carrier rate can be controlled by starting early. That a carrier rate of 20 per cent. in the community is necessarily to be regarded as a danger signal may be a sound principle in practice, but it still lacks proof. It is curious that little or no attention has been paid to prophylactic vaccination in view of the promising results obtained by Penfold at Salisbury in the early days of the epidemic. On the purely bacteriological side I would offer a few remarks only. We are deeply grateful to the bacteriologists of the Royal Army Medical College and the Ministry of Health for the amount of data they have produced. Final judgement as to the exact number of serological types and their interrelationship, and as to the significance of certain nasopharyngeal types which it has been found difficult to place, must, I think, be postponed—at least I cannot adjudicate in the matter—though I am more inclined to the view of Eastwood and his colleagues. As systematic bacteriologists we have to face seriously the question of the relationship of pathogenic organisms to their homologues, whether as in cholera they occur in water and soil, or in cerebro-spinal fever in a saprophytic state on the nasopharynx.

It seems to me that the work done on the serological grouping of meningococci has had its chief result in serum therapy, and the inference to my mind is that the more polyvalent such a serum is, the more generally potent it is likely to be. I cannot see where the practicability of monovalent serums comes in. With regard, finally, to the studies of Colonel Gordon on the reductases of the meningococcus and the presence of a heat-stable haemolysin in its alcoholic extracts, I do not think that they bring us any nearer to an understanding of the way in which the meningococcus exerts its deleterious action on the tissues. Since the work of Cathcart and Hahn and Schultze and Kramer many years ago it is well known that practically all organisms tested exhibit reducing powers. The heat-stable haemolytic substance present in alcoholic extracts of bacteria has also been thoroughly studied, and does not seem to have any connexion with true bacteriolysin or with virulence or anything else. It appears, indeed, to be analogous with a similar heat-stable lysin which can be obtained from alcoholic extracts of organs.

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As the question of serological differentiation of micro-organisms has been discussed by Dr. Arkwright in general terms, I should like to ask a few questions and to make a few remarks concerning this aspect of his paper.

Dr. Arkwright takes as the typical example of a satisfactory serological test, agglutination of *Bacillus typhosus;* but, surely, because of the ease with which flocculation of a "typhoid-anti-typhoid serum complex" can be demonstrated, he does not suggest that the application of similar tests to other organisms, although less easily conducted, is necessarily invalid. It so happens that the reaction in this instance is demonstrable under a greater variety of conditions than is the case with other organisms when these are exposed to their appropriate antiserums. Flocculation of antigen-antibody complexes occurs only under certain conditions, and sometimes these conditions are strictly limited.

Attention is also drawn by Dr. Arkwright to the occurrence of inagglutinable strains of *B. typhosus*, *B. paratyphosus*, etc. But are these of frequent occurrence? And are we not in danger of calling attention to exceptional strains, while neglecting to lay due stress on the great majority of strains which behave "normally"? Are the inagglutinable strains not really freaks? I feel, too, that Dr. Arkwright was unfortunate in citing inagglutinable strains of Shiga bacillus as an instance of the failure of agglutination as a method of differentiating bacteria. I presume that the strains of Shiga bacillus referred to were isolated from cases of dysentery. May not certain of these strains of inagglutinable Shiga bacilli really be Schmitz bacillus, which has been known to be responsible for the causation of epidemic dysentery in certain parts of Europe?

So far as the Flexner group of bacilli is concerned, one must agree with Dr. Arkwright that agglutination is an unsatisfactory method of examining such organisms, and does not lead to definite results; but, on the other hand, may I point out that, so far as the meningococcus is concerned, 98 per cent. of the cocci isolated from the *spinal theca* can be grouped by means of four monotypical agglutinating serums? Now, from the spinal theca it is easy to isolate an organism which, pus being present, one can be fairly satisfied is responsible for the causation of disease; but, on the contrary, with the numbers and variety of the organisms in the normal, let alone the pathological intestinal, contents, it is not so easy to be satisfied that any particular organism isolated is really of prime pathological significance. A criticism of the methods for differentiating the meningococcus used at the Central Cerebro-spinal Fever Laboratory, and the military laboratories co-operating with it, based on a discussion of the Flexner group of dysentery bacilli, appears to me, therefore, to be of very questionable validity.

Dealing with Dr. Arkwright's remarks concerning absorption of agglutinins, one must, of course, agree that this reaction obviously has its limits. But, again, I call attention to the fact that 98 per cent. of meningococci of spinal origin would, when tested by a standard technique as regards culture, agglutination, and absorption of agglutinins, fall into one or other of four serological types—absorption of agglutinins being necessary definitely to place a few only of these cocci in one or other of the groups. I have designedly laid stress on the employment of standardized technique in all phases of the investigation: in culture, because it is well known that a change of culture medium may alter the agglutination properties of certain micro-organisms. Bordet observed this change to occur in the case of the whooping-cough bacillus in a very striking manner, and since then it has been shown by other investigators that kindred changes in agglutinability or agglutinogenic capacity may be brought about by culture in the presence of antiserums and by other methods. Still more stress is laid on the standardization of the serological tests, for the obvious reason that we are ignorant of the intimate mechanism of these. We do know, however, that a slight variation in the conditions of an experiment may upset observable phenomena in physical chemistry, and there is more than a suggestion that the process of agglutination is a physico-chemical phenomenon. Of course it may be asked, What justification have you for

setting up arbitrary standards? Well, even the metric system is a number of interrelated arbitrary standards, but it cannot be gainsaid that it is extremely valuable. Again, no one would contemplate carrying out a Wassermann test without most careful standardization of every reagent; the Wassermann test is a purely empirical reaction, and its success depends entirely upon setting up arbitrary standards, but its value is none the less considerable. My argument, then, is that as a practical method the agglutination technique as employed by Gordon and his associates gives valuable information otherwise unobtainable.

Turning to another matter, I should like to ask Dr. Arkwright what precisely he means when he quotes my work on tetanus. I do not wish to be misunderstood in this matter, and I ask forgiveness for making a short summary of the results which were obtained.

1. It was shown that the exotoxins of all the agglutinating "types" of *Bacillus tetani* appeared to be the same.
2. It was also shown that the exotoxin was not the only factor of pathogenic importance in infection with *Bacillus tetani*, for fresh whole cultures of that organism were found to possess antiphagocytic properties which could only be overcome by the use of *homologous* anti-serums. These results were perfectly definite *in vitro*, while corresponding experiments *in vivo* were suggestive when it is borne in mind that the technical difficulties of setting up a "controlled infection" with *Bacillus tetani* are almost insurmountable.

With regard to Dr. Ponder's paper, I should like to give my own experience in the investigation of inagglutinable strains from the nasopharynx which were supplied to me by Dr. Glover. In this series of 40 nasopharyngeal strains were a few cultures which Dr. Glover regarded, from the results of his routine agglutination tests, as true meningococci, but he gave me no information concerning which of these 40 he did regard as meningococci. Very many of these Gram-negative cocci obtained from the nasopharynx, although they exhibited all the cultural and fermentative reactions of the meningococcus, failed to qualify as that organism when fully tested by serological methods. With the exception of the cocci, which Dr. Glover regarded as meningococci, not one of the series of 40 qualified as a meningococcus on subsequent examination by agglutination and absorption of agglutinin, notwithstanding the fact that 23 out of 28 of these, when tested by cultures in carbohydrate media, gave the reactions of the meningococcus. These results, contrasted with the 98 per cent. of positive reactions obtained in the case of spinal strains using the same technique, are, to say the least, striking. Furthermore, when agglutinating serums were made from these cocci, which were inagglutinable with meningococcus agglutinating serum, it was found that the serums obtained did not agglutinate to any extent, at least the majority of meningococci, and the meningococci which did show group agglutination with these serums, failed to absorb from them the specific agglutinins for the ("inagglutinable") strain with which they were prepared. Moreover, the multiplicity of serums required to agglutinate these meningococcus-like organisms of pharyngeal origin is such that nearly every coccus of this kind requires a serum specific to itself—very different from what obtained in the case of thecal strains. It cannot be sufficiently emphasized that the starting-point of any investigation of this kind must be a thecal strain or thecal strains. Pharyngeal strains must not be used for the preparation of agglutinating serums which are designed to be used for diagnostic purposes.

Finally, it must be appreciated that all the work on differentiation of serological types of pathogenic organisms is only of importance if it can be correlated with the preparation of therapeutic serums. I submit that the case for monotypical therapeutic serums in the case of meningococcal infection is not proven; but I do think that the whole of the question of typing by agglutination is worthy of extended investigation, particularly in view of recent work carried out with other organisms, notably the pneumococcus. This question of relationship of "types" to the preparation of therapeutic serums should be gone into once for all on a large scale and definite information obtained for our guidance in future.

CHARLES GRAY, M.D.Edin.

As my work in connexion with cerebro-spinal fever has been almost entirely confined to the clinical side, any contribution I can make to this discussion must be limited to questions relating to the use of therapeutic serums.

I do not think there can now be any doubt as to the value in treatment of a good antimeningococcal serum. At Fulham we were treating all the military cases for the whole of the London area from December, 1915, to April, 1919, and our mortality had a definite relation to the intrathecal use of serum and to the quality of the serum employed. The experience of other observers, such as Flexner, Ker, Rolleston, Worster-Drought, and others is in the same direction. If any further confirmation be needed it is to be found in the facts to which Dr. Gordon has drawn attention as to the differing mortality among civilian and military cases in the past epidemic—a difference which must have been largely due to the special provision of serum for the military cases.

Dr. Arkwright refers to the alternative of the use of mono- or poly-valent serum as a vexed question. From the clinical point of view there can be, I imagine, no doubt whatever that a polyvalent serum must be employed for at any rate the first few days of treatment. The importance of early treatment cannot be too strongly emphasized. Of thirty-three cases treated at Fulham with the exceedingly good Lister serum of 1915–16 on or before the third day of disease, the mortality was only 9 per cent., whereas in cases treated with the same serum *after* seven days the mortality was 50 per cent. Owing to the circumstances of the case we had seldom an opportunity of commencing treatment on the first day, though I had one rapid recovery in a case treated within twelve hours of onset, but Worster-Drought had no deaths in five cases treated on the first day. Netter, Dopter, and Flexner report the same low mortality with early treatment. In my experience, in an overwhelming majority of the cases, it is the first three days of treatment which really settle the issue. Now, treatment in those days must be with polyvalent serum. So far it has not been possible to obtain information as to the type of coccus before at least the third day, frequently it is the fourth, and there will always remain a small percentage of cases in which, with the best will in the world, the type is never determined. I am so impressed with the value of early treatment, and I have had so little success with monovalent serum in cases which were doing badly with polyvalent, that I should be perfectly content, as far as treatment goes, to dispense with attempts to discover the type of coccus, given the provision of a serum which is really antimeningotoxic to all varieties.

It is not safe to anticipate the type in any given case, for although in different periods of a prolonged epidemic a majority of the cases may belong to one type, cases of other types turn up fairly frequently.

Not much appears to be known as to any relation between methods of preparation of serums and serum sickness, but in my experience the occurrence varies considerably with different serums.

Thus, in the series of cases treated with the 1915–16 Lister serum, the percentage of cases surviving ten days or longer which were affected was 37.5; in 1917–18, using a very good Lister serum, No. 47, this percentage was 57.7; and with the Medical Research Committee's serum, which gave us very good results with Types I and II, the percentage rose to 89.8.

This variation is not to be explained by variation in dose, as, with a few exceptions, the dose was the same. The day on which the symptoms first appeared varied from the third to the fourteenth day of treatment, the average being the ninth.

In my series of over 170 cases I have had only one instance of true anaphylaxis.

This occurred in a patient (K.) who, after a clear interval of fourteen days from the previous administration of serum, had a relapse, accompanied by a return of meningococci in his cerebro-spinal fluid. He was given 30 c.cm. of autogenous serum intrathecally and 15 c.cm. of Flexner's serum intravenously. Within five minutes of the administration he passed into an alarming condition, with extreme pallor, imperceptible pulse, fluttering heart, and rapid sighing respiration. Within half an hour, adrenalin and oxygen having been administered, he rallied, and eventually made a good recovery.

Disappearance of meningococci from the cerebro-spinal fluid is not by itself a reliable guide for the cessation of administration of serum. The observation must be correlated with that of the patient's clinical condition. Cocci very generally disappear from the fluid after the third day of

treatment, but if serum is then withheld it not infrequently happens that the patient becomes worse.

It is unfortunate that no reliable method of standardization has yet been arrived at. Many of the commercial serums on the market are quite useless, and may lull the administrator into a false sense of security. It is to be hoped, and I believe justifiably, that the Ministry of Health or the Medical Research Council will undertake to standardize and guarantee as far as possible all varieties of therapeutic serums.

Dr. GARDNER ROBB (Belfast) agreed with Dr. Arkwright that polyvalent serums were of more general use than monovalent serums. Had he Dr. Gordon at his elbow to type the organism it might be a different matter, but left to his own devices he would certainly use the polyvalent serum. In his opinion the results with polyvalent were as good as those with monovalent serum if the statistics were carefully studied. The disadvantages and want of experience of early workers must be remembered. Fallacies might arise if age periods were not taken into account. In infants, for instance, the mortality was much higher than in people of military age. In infants an early diagnosis was much more difficult. They were brought to hospital late in the disease, and the results of treatment could not be as good. The death rate of cerebro-spinal meningitis at Belfast, taking all cases, was 27 per cent. In military cases it was 12 per cent. But when infants were excluded the civilian death rate was only slightly above that of the military.

Dr. SCOTT agreed with Dr. Arkwright as to the difficulties of separating the different strains of meningococci. He did not think there were any magic number of types. The four types described by Gordon were the commoner ones. The meningococcus was a common inhabitant of the nasopharynx. Under conditions of overcrowding it passed rapidly from one individual to another and thereby acquired special virulence. If the passage of the coccus from one individual to another could be prevented its virulence did not increase.

OPENERS' REPLIES.

Dr. ARKWRIGHT, in reply, remarked that there were many things he would like to say but time did not suffice. In reply to Dr. Tulloch, he thought the latter had misunderstood his statement about *B. tetani*. He had quoted Dr. Tulloch's own work. The character of toxin production did not correspond to the varieties of agglutination reaction. With regard to the figures on the board to which Dr. Tulloch took objection, he had merely put them up to show that there were a certain number of strains which Dr. Tulloch had been unable to group. He assured Dr. Tulloch that it was not of Schmitz's bacillus that he was speaking when he referred to the difficulties of agglutinating varieties of *B. dysenteriae* (Shiga). In classification one must take several characters into account. To trust to one character alone was rather like putting the leopard and the giraffe into the same group because they both had spots. Agglutination alone was not a safe guide. For finding similarities one method, simple agglutination, was good, for finding differences absorption was useful. Gordon's groups were too hard and fast. The real importance of grouping lay in its practical application to clinical considerations and to the manufacture of therapeutic serums. So far, the division into numerous sub groups had not been proved to have practical results. He wished there had been time to discuss other aspects of the subject. It would have been interesting to get more evidence as to the mode of entry of the organism.

Dr. GORDON said that any effort to limit the spread of the meningococcus must take into account the varying susceptibilities of different classes of individuals. Recruits were much more susceptible than old soldiers. Prevention of overcrowding was the most important measure. The steam spray was only advised when overcrowding was unavoidable. It was effective in lowering the incidence of the disease. Vaccination was inadvisable. Prophylactic inoculations were tried in one brigade, but the results were not encouraging. The war was a test of bacteriological efficiency. The crucial test was the ability to prevent and cure cerebro-spinal fever. The differentiation of the meningococcus into four main groups by agglutination (and absorption) in 1915 was confirmed by the experience of four succeeding years. At the present time four groups of meningococci were recognized in France and apparently in America also. He thought Dr. Arkwright's doubts were answered by the results summarized in his paper. No doubt the groups of meningococci could be subdivided still further. The complexity of Type II had always been insisted on. For the successful identification of the meningococcus in practice the same standard procedure was used throughout. The same medium—namely, trypagar, which contains pea extract—was employed, and care was taken to obtain monovalent agglutinating serums representative of current strains. It was a testimony to the care taken by Major Bell, who prepared these agglutinating serums latterly, that out of the last 200 meningococci received at the Central Laboratory only one was unplaced. In practice the identification of meningococci was simple; there were needed: (1) suspensions of meningococci of four types (2,000 million per cubic centimetre); (2) monotypical agglutinating serums for these types of known titre; (3) control normal serum; (4) small tubes, racks, pipettes, saline, and 55° C. incubator. The procedure was so simple that bacteriologists who had never done it before were taught it in a few days. As regards monovalent *versus* polyvalent serums, monovalent serums were only undertaken as a preliminary to producing an efficient polyvalent serum later of standard quality.

A PHYSICAL THERAPEUTIC CENTRE:

AN EXPERIMENT BY THE NORTH STAFFORDSHIRE COAL AND IRON MASTERS ALONG THE SUGGESTED LINES OF FUTURE MEDICAL SERVICE.

BY

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IN view of the great interest which is being taken in the interim report of the Medical Consultative Council,[1] and of the report of the Departmental Committee on Workmen's Compensation,[2] the following account of the establishment and the results of the first year's working of a "massage centre" for the treatment of injured workmen will be interesting both to medical men and to employers of labour.

In the interim report great stress is laid on the establishment of local centres; in the report of the Departmental Committee it is recommended that any medical and surgical aid necessary in addition to the medical treatment already available under the National Insurance Act should be provided at the cost of the employer under a comprehensive scheme to be worked out in co-operation with the Ministry of Health (2, paragraph 75).

The employers of the coal and iron industries are united in this district in a mutual indemnity society, and the "centre" has been established and financed by them for the free treatment of injured workmen in receipt of compensation. Although the methods of treatment employed are in common use to-day, it is thought that the "centre" in question is the first of its kind in this country, combining in itself the two principles of local centralization of the future scheme of the Ministry of Health and of medical responsibility of the employers under future Workmen's Compensation Acts.

Reasons for Formation of Centre.

It was pointed out to the employers that much time was lost by the workmen from lack of what might be called *intensive* after-treatment of injuries by *daily* massage, suggestion, and exercises. It was shown that the local institutions, largely from overcrowding by pensioners, were overworked, and that the panel practitioners were not in the position to carry out the necessary treatment. The employers realized that any efforts on their part to alleviate the sufferings and bring about the return to normal function of their injured workmen would be greatly appreciated by the workmen themselves.

Establishment of Centre.

The district is comparatively compact, and the train and tram services are good. The number of employees is

45,000, and 80 per cent. live within a five-mile radius of the centre. The President and Past-President of the local Branch of the British Medical Association were asked to advise as to procedure. It was decided that if the employers' medical officer thought that any man attending for examination in accordance with the regulations of the Workmen's Compensation Act would be benefited by special treatment at the centre—the medical practitioner in attendance should be notified and his permission obtained. The following letter was drawn up (to be sent by post):

Dr. .....

.....

I saw your patient ..... this morning, and think a course of massage (and electrical treatment) would accelerate his recovery. With your permission I will arrange this course of treatment at our centre (address given). If you agree, no answer need be sent to this letter, but I should be pleased to receive any suggestion you desire to make.

(Signed)

.....

Medical Officer.

Once the permission was given, the man was then considered to be under the care of the employers' medical officer. The staff and equipment of the centre was as follows:

Personnel.

Employers' medical officer in charge.

Two masseurs, both ex-sergeants of the R.A.M.C., with special experience of massage, physical drill, general athletic training, and electrical treatment.

Equipment.

One large furnished room in the local Church Institute was hired at a rent which included cleaning, light, and a supply of hot water, and equipped as follows:

Two couches for massage.
One Mennell's combination apparatus.
One bicycle on rollers (home-made at inclusive cost of £5 10s.).
Two pairs of Indian clubs (one very light—sceptres).
One pair of grip dumbbells.
One pair of Terry's spring developer.
Rubber balls and home-made finger exerciser.
One galvano set with hospital outfit complete—faradic coil, metronome, set of Schnee baths, etc.
One electrical vibrator.
One cupboard containing: Two blankets, four pillows, one dozen towels, four white coats, nail-brush and soap, box with cards and card index, stationery, olive oil, boracic powder, two dredgers, solutions of sodium iodide, sodium salicylate, and sodium chloride for ionic medication, iodine, lint, bandages.

ROUTINE OF TREATMENT.

The injured workman received, either directly or through his medical attendant, a slip containing diagnosis, prescribed treatment, and directions for finding the centre. Particulars of each patient were entered on a separate card, which was stamped for every attendance. Each week the workman was given a certificate by the masseur, stating the number of attendances and entitling him to travelling expenses.

The object of the treatment was explained to the man, and every effort was made to secure his intelligent co-operation. On his first visit successful cases were brought to his notice, and the influence of suggestion was employed whenever possible. Great stress was laid on the use of exercises which could be repeated by the patient at home. In the early stages of active movements the necessity for mental concentration on the movement is insisted on; for instance, if the man has to dorsiflex his foot he is told to say to himself with each movement "I am bending my foot."

Cases Illustrating the Results of Daily Massage and Exercises.

J. H. July 18th, 1919, fracture of femur, upper third. September 29th, treatment started. December 16th, resumed light work.

J. B. April 9th, 1919, fracture of left tibia. January 8th, 1920, treatment started. April 28th, resumed work.

J. K. January 9th, 1920, dislocated shoulder. January 20th, treatment started. February 6th, resumed work.

G. M., aged 61. August 16th, 1919, dislocated shoulder. August 20th, treatment started. September 8th, resumed work.

Compare the last two cases where treatment was started soon after injury with the following:

J. L., aged 64. Dislocation of shoulder one year ago. Marked limitation of movement and wasting of muscles of shoulder girdle. No work since accident. July 8th, 1919, treatment started. August 10th, resumed light work with good range of movement of shoulder.

One of the most striking cases was the rapid recovery of a crushed hand with marked swelling of all the fingers and complete loss of movement. There was no fracture, but all the finger-joints were swollen. Treatment was started two days after injury and there was complete movement in all the joints in twelve days.

Walking Exercises.—Special attention has been paid to walking exercises. Patients continue to use their crutches for long periods because they are afraid to trust to their injured leg, and forget how to use it properly. All men arriving on crutches are given walking exercise at once. They are taught to walk by numbers, and the results of a few lessons are very striking.

J. T. April 14th, 1920, fracture of second metatarsal bone. May 21st, came to centre on two crutches. May 26th, walking with one stick. June 5th, resumed work.

D. S. September 4th, 1919, sprained ankle and contused foot. September 24th, came to centre on crutches quite unable to walk. September 25th, walked across room without help. October 13th, resumed work.

Directions for Exercise.—From position of hips firm. *One*, the whole weight resting on the right leg, carry the left foot forward about twelve inches, toe raised, heel touching ground. *Two*, whole weight remains on right leg, left foot flat on ground, both legs braced. *Three*, weight transferred to left leg, right heel raised, both legs well braced. *Four*, flex right knee and prepare to carry right foot forward at "one."

In all cases massage was started in the proximal segment of the limb, and the value of "taking the stopper out of the bottle" (Mennell)[5]—that is, starting with massage to the thigh for injuries to the ankle—was strikingly proved in many cases.

H. B. February 17th, 1920, contusion of leg with septic wound on outer side of ankle, oedema of the leg, and varicose veins. May 27th, massage to thigh started. The wound, which had been open for over two months, healed soundly in a week. June 14th, resumed work.

W. P. January 11th, 1919, fracture of femur. June 24th, brought to centre in a chair. Marked oedema and swelling of the whole of the left leg. Movement at knee-joint lost. July 6th, the leg is still swollen but the man is able to get about on crutches. Movement at knee, 25 degrees. August 15th, walking with sticks. September 26th, started light work. Knee movement complete.

J. L. October 6th, 1919, laceration of hand. The wound, which extended across the back of the hand, refused to heal. December 3rd, massage started. The wound healed in less than one week.

Resistance Exercises.—Two cases of disordered action of the heart resulting from strain were treated with graduated resistance exercises combined with light massage and faradism over the cardiac area. The results were not satisfactory, although the men eventually returned to work.

Electrical Treatment.

In all cases where there had been marked wasting of the muscles interrupted galvanism was given in addition to massage and exercises.

J. D. Severe contusion of right leg with drop-foot and R.D. in anterior tibial group of muscles; resumed work in four and a half months.

G. F. January 9th, 1920, operated on for exostosis of femur said to have been caused by a blow. March 4th, very marked wasting of muscles of thigh with stiffness of knee-joint; treatment started. March 11th, knee can be completely flexed. May 1st, resumed work.

In the early stages of injury to the back, treatment with massage, exercises, and vibration was generally successful. In the more chronic cases, and especially where a state of neurasthenia had followed an old back injury, general galvanism with Schnee baths, and faradism to the spine were employed with a certain amount of success.

A. P. December 10th, 1918, strained back. July 12th, 1919, typical neurasthenic, complaining of general pains, palpitation, nervousness, and inability to bend back. Treated with general massage, suggestion, galvanism, with Schnee baths, vibration, and general exercises. He resumed work after three months, and is now working five turns a week driving an underground haulage engine.

G. B. October 30th, 1919, general bruising of body. April 14th, 1920, no work since accident. General pains in the back. Unable to lift any weights. Treated with general massage, exercises, and galvanism to spine. May 1st, resumed work.

W. D. January 24th, 1919, strained back shortly after return to civil life. Complains of constant pain in the back, increased on movement; unable to lift anything or to lace his own shoes. Magnificent physique—sergeant-major drill instructor. No physical signs, except a pulse rate of 100. August 11th, massage to spine and mild faradism through hand of operator. The man refused to attend after the second day. Pressure was put upon him and he attended irregularly for four months without any improvement. The case was then commuted.

J. L. January 14th, 1919, strained back lifting load. Kept in bed in cottage hospital for several weeks. October 8th,

complains of pain and weakness of the back. Walks bent up with the help of a stick. Schnee baths and general massage. He attended regularly, and made such marked progress that he resumed work at the coal-face on February 13th, 1920. He was unable to satisfy his fellow workers, and gave up work on March 23rd. The man is quite fit for light work, but is still unable to follow his old employment.

Ionic Medication.—Treatment with ionic medication was carried out in cases of synovitis of the knee-joint which did not yield to the ordinary treatment. Ionization with sodium salicylate was used in painful affections of the joints. In three cases of chronic suppuration near the ankle ionic medication gave temporary relief, but all three cases were eventually transferred back for surgical treatment. One interesting case of miner's elbow yielded to ionization with sodium iodide:

G. N., whilst attending the centre for contusion of the right shoulder, suddenly developed a large bursa over the left elbow. Ionization with sodium iodide cleared up the condition in one week. The man returned to work and the bursa reappeared. It was again successfully treated in the same manner. The chief interest of the case is the sudden appearance of the bursa while the man was "playing."

General Results of Treatment.

It is interesting to note, as showing the growth of the centre in the esteem of the local medical men and the workmen, that 181 cases were treated in the first six months and 310 in the second six months. The appreciation shown by the workmen for the efforts made by the employers on their behalf has been very gratifying. It is important to note that many long-standing cases were taken over by the centre and that return to work does not necessarily mean return to old employment.

Table Showing the Number of Workmen Treated, the Average Attendance, with an Analysis of the Cases.

Total number of cases treated	491
Number of attendances	7,558
Number of working days	300
Average weekly attendance	145
Average daily attendance	25
Average attendance per case	15.4

All Cases.

Completed cases	446
Still under treatment at centre	42
Transferred for surgical treatment	3
	491

Completed Cases.

Returned to work	425
Settled for lump sum	12
Not improved	6
Refused treatment	3
	446

Analysis of Completed Cases.

		Average Attendance.
Upper Extremity:		
Contusion of fingers or hand	61	6.7
Cellulitis of hand	10	31.0
Fracture of thumb	2	16.0
Fracture of fingers	16	15.0
Fracture of metacarpals	13	15.0
Amputation of finger	9	12.0
Contusion of wrist	15	12.0
Contusion of forearm and elbow	11	9.0
Fracture of forearm	18	13.5
Dislocation of elbow-joint	3	27.0
Fracture of humerus	3	13.0
Contusion of shoulder	12	13.0
Dislocation of shoulder	9	27.0
Fracture of clavicle	2	5.0
Lower Extremity:		
Contusion of foot	21	7.0
Fracture of metatarsal	10	18.0
Fracture of astragalus	1	32.0
Contusion of ankle	11	5.5
Fracture of leg	33	30.0
Synovitis of knee	46	16.0
Contusion of thigh	9	10.5
Dislocation of hip	1	7.0
Fracture of femur	5	46.0
Fracture of pelvis	1	48.0
General:		
Contusion of chest	9	8.0
Strained back	64	9.5
Neurasthenia following old back injury	9	48.0
Miner's elbow	1	9.0
Post-operative muscular wasting	1	24.0
Paralysis of anterior tibial nerve	1	64.0
	446	

Settled Cases.—Twelve cases were settled; all of these showed considerable improvement, but no suitable work could be found.

Injury to back 6 (3 neurasthenics who only showed slight improvement).
Fracture of pelvis 1, fracture of femur 2, fracture of leg 1 (all these men were able to do light work).
Fracture of thumb 2 (settled for small sums).

Not Improved (6 cases).—Injury to back 3, old dislocation of shoulder 1, old fracture of wrist 1, contraction of hand due to cellulitis 1.

Refused Treatment (3 cases).—Neurasthenia following injury to back 3.

Still under Treatment at End of Year (42 cases).—Twenty-three cases returned to work at the end of the thirteenth month, and in only two cases is complete failure anticipated. These are two cases of rheumatoid arthritis of the knee-joint where injury has supervened.

Cost of Establishment and Current Expenses.

The apparatus and electrical outfit cost £92. The current expenses were: Wages £366, rent £39, sundries (drugs, dressings, etc.) £14—a total of £419.

Allowing one quarter of the original cost for depreciation, the total cost of the year's working was £23 + £419 = £442. As the total number of cases treated was 491, the average cost per case was 18s. The cost of travelling expenses is not included, and will of course vary with each district. Where the medical officer is not a full-time official, it will also be necessary to add his pay to the current expenses.

With the present high wages the full compensation of 35s. a week is paid to everybody. It is only necessary, then, to expedite the injured man's return to work by one week to make the massage centre a financial success. The employers are quite convinced that this result has been achieved. If the recommendation of the Departmental Committee becomes law, compensation will be paid at the rate of £3 per week, and the saving effected correspondingly greater.

General Conclusions.

The loss of function which results from disuse, formation of adhesions in joints, and, above all, from the mental inertia which follows most serious injuries, can only be satisfactorily treated in large infirmaries, hospitals, or specially provided local centres. Treatment should be given daily, and begun as soon as possible after the accident. Return of normal function should be the only aim; it is useless to obtain perfect alignment of a broken bone with stiffness of adjacent joints or to preserve a finger which cannot be flexed into the palm. The results of the first year's working of this centre show that both employer and employee have benefited.

In this district the centre is no longer an experiment, and the employers have recently purchased accommodation for its permanent establishment.

References.

[1] Report of Medical Consultative Council to the Minister of Health.
[2] Report of Departmental Committee on Workmen's Compensation, Cmd. 816.
[3] Mennell, *Massage: Its Principles and Practice*, p. 19.

NEUROLOGICAL JOTTINGS.—II.

BY

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Chicken-pox and Herpes.

SINCE the publication of my paper on "Neurological Jottings"[1] I have had several communications on one of the subjects on which I wrote—namely, the curious connexion between herpes and chicken-pox, and there have also been several communications to the JOURNAL on the subject. In my former paper I referred to several instances of chicken-pox occurring in the same house in which herpes had been present at or about the time at which chicken-pox occurred. In all the cases which had come under my observation or of which I had authentic first-hand information, herpes had occurred in an adult and had been followed by chicken-pox in younger persons, chiefly children.

Dr. Ingram Cooke[2] relates the case of a girl of 16 who came to his surgery for some medicine for her father, who had developed shingles about two weeks before. She asked

Dr. Cooke about a "rash" which had appeared on her body on the previous day. Dr. Cooke found that she was in the early stage of an attack of chicken-pox. This subsequently developed into a characteristic attack, with a good crop of vesicles and a temperature of 102°. There was no other case of chicken-pox in the neighbourhood. Dr. Pereira Gray[3] of Exeter wrote as follows:

"There is, no doubt, a close connexion between shingles and chicken-pox. At any rate, they frequently occur together or closely follow each other. But whether the one is the cause of the other or both are dependent on a common factor must be left an open question."

I am permitted also to quote the following two letters. The first is from Dr. H. G. Turney, Senior Physician to St. Thomas's Hospital. He writes:

"I was much interested in your reference to the relationship between shingles and chicken-pox—a fact that I have been convinced of for some time past. Just now a somewhat striking example has come under my notice which may interest you. A married sister of my wife's now living in Edinburgh has two children who during February were laid up with mumps. A maiden aunt, while not actually living in the same flat, spends most of her time with them, and in fact carries on their education. On March 10th, after a day or two of malaise, she developed shingles and was received into the flat to be nursed. Both children developed chicken-pox on March 27th. One of them had, since the mumps, paid a visit to Glasgow and so came into possible contact with infection, but the other had been isolated, and so far as can be traced cannot conceivably have been infected from without. Moreover, the illness took both children on the same day and must presumably have arisen from the same focus. Suspicion points very strongly to the aunt and her shingles, for nothing is known of any other possible source of infection."

I am also allowed to quote the following very interesting communication from Dr. Dorward Brown of Harrogate. He says:

"I was greatly interested in what you say in your paper as to herpes and chicken-pox and their relationship, and hope the following personal experience may interest you: A month ago I had a severe attack of shingles, radiating from the second, third, and fourth dorsal areas across the back and under the axilla to the sternum. A fortnight afterwards my daughter, aged 11, had a mild attack of chicken-pox. During my attack of shingles I also had some isolated vesicles scattered over various parts of my body. Following up this I found that a lady whom I was attending for shingles just before my own attack had been in contact with a family with chicken-pox. Lastly, I was consulted a few days ago by a patient from Bournemouth who has had an attack of herpes, and he informs me that his son and housekeeper followed him with chicken-pox."

I saw also, a short time ago, a lady, a patient of Dr. Edward Lewis, who told me that about a year ago she had had an attack of occipital herpes, and that her daughter within a fortnight had an attack of chicken-pox! Dr. Claude Wilson of Tunbridge Wells[4] also relates an interesting experience:

"A patient, A. L., came to Tunbridge Wells with his wife and son, F. L., on April 10th. They lived in apartments, and on April 13th A. L., aged 49, complained of a pain in the right groin and leg. Two days later vesicles appeared on the right buttock, the commencement of a herpetic eruption which, commencing in the inguinal region, spread over the inner side of the right thigh and calf, and on April 17th he was seen by Dr. Wilson, when the condition was a characteristic one of herpes. On May 1st F. L., the son, aged 18, noticed a few pearly spots on his forehead, and by May 3rd he was covered with hundreds of typical chicken-pox spots, distributed all over the body, accompanied by considerable pain and much constitutional disturbance. So far as can be ascertained, he had not been near any case of chicken-pox."

These instances seem to me to furnish very strong evidence of the close connexion between shingles and chicken-pox, and to lend support to the plea conveyed in the paper by Dr. Le Feuvre, referred to in my first communication, that "shingles should be recognized as an infectious disease, and one, under certain unknown conditions, likely to become a starting-point for a chicken-pox epidemic."

Early Phases of Disseminated Sclerosis.

Disseminated sclerosis is now recognized as one of the most curiously protean diseases, especially in regard to its early symptoms. It often simulates hysteria, as Dr. Thomas Buzzard pointed out long ago, and there is little doubt that even now many cases, not all of them in the early stage, are wrongly regarded as hysterical. In the early stage there may be no sign indicating organic disease. A girl happens to knock or strain her arm, and finds that she cannot move it. In such a case a gentle application of faradism may remove what is apparently merely a functional disturbance. But after a few weeks or months, if there is a recurrence of the trouble, associated with tremor or nystagmus, there is then unfortunately no doubt that structural changes have supervened. I do not mean to say that every functional condition in which no evidence of structural change exists necessarily develops later into one of disseminated sclerosis, but undoubtedly some do, and it is well to be on the lookout and to recognize that functional paralysis may result from central changes which are slight and of which the obvious manifestations are transient.

I recall the case of a clever young Jewess who had worked very hard, and who consulted a colleague on account of paralysis of the left arm which she found to be present one morning. There were no signs of organic disease, and an application of faradism was followed by immediate restoration of function. Six months later she came again with a recurrence of weakness and tremor in the arm, and complaining also of slight difficulty in walking. The arm improved after treatment, but it was found that she had exaggerated knee-jerks and ankle clonus, also that nystagmus was present. This patient rapidly developed all the signs of disseminated sclerosis; she became unable to walk, and died four years after the onset of the transient paralysis of her arm.

Squinting and ocular palsies are sometimes also transient and of equal significance. Some years ago I saw a girl of 18 who was working for an examination, when her eyes began to trouble her. I saw her in consultation with an ophthalmic surgeon, who insisted that the condition was hysterical. I could not share this view because the squinting was such, in my opinion, as could not be feigned. It cleared up, however—a fact which seemed to favour the view that it was hysterical. There was a recurrence some months later, which also cleared up; but later marked nystagmus developed, and the case became one with all the classical signs of disseminated sclerosis.

As illustrating the various modes of commencement of disseminated sclerosis I may mention the case of a young lady whose physical health and hygienic environment seemed perfect. She had noticed some mistiness of vision, and consulted Mr. J. B. Lawford, who found that she had optic neuritis in each eye, and he sent her to me in order that I might examine her with the view of discovering, if possible, some cause for this. There was no headache or vomiting—nothing to indicate any intracranial trouble. The only definite sign I could discover, apart from the condition of the optic discs, was an extensor response from one sole. She had no difficulty in walking, although she confessed to feeling more easily tired than usual. I need only say that, in spite of enforced rest under excellent conditions as regards food, fresh air, etc., she rapidly developed all the signs characteristic of disseminated sclerosis, and died less than two years after the trouble with vision began.

It has often been noticed that there are several superficial points of resemblance between some cases of disseminated sclerosis and cases of general paralysis of the insane—especially is this the case with reference to mental symptoms. There is the same mental "facility" in many cases of disseminated sclerosis which is so striking and almost characteristic of general paralysis—one is struck by the fact that patients suffering from disseminated sclerosis so often express themselves as feeling so well and that they do not seem to be concerned about their helplessness. Frequently, too, they are even amused by their disabilities. In some instances it has been difficult to be sure of the diagnosis. I can recall two cases in which the original diagnosis of disseminated sclerosis was definitely contradicted by the course of the illness. One was a hospital patient who had nystagmus, slurred speech, weakness of the legs with exaggerated knee-jerks, and extensor responses, and volitional tremor of the hands. The pupils were equal and reacted to light and during accommodation. There was no history of syphilis, but there was extensive destruction of the palate, apparently of syphilitic origin. This man remained in hospital for some weeks, but no change supervened. I learnt afterwards, however, that he developed mental symptoms and had to be certified.

The other case was that of a man who was sent to me some years ago by Mr. William Lang, who found that he had

definite pallor of his discs, with little or no visual impairment. There was nystagmus, but no pupillary change, and, although he walked rather feebly, the knee-jerks were present and active, and there was no change in the plantar response. He spoke slowly and with slightly slurred articulation. I regarded the case as one of disseminated sclerosis. He continued in the same condition for five years, when he developed mental symptoms of the grandiose character so often met with in general paralysis; he became very fat and then wasted and died, the mental condition becoming one of profound dementia before he died. In this case, in spite of the early changes in the discs which Mr. Lang had noted, there was no progressive deterioration of vision, but I think the case, although the progress was unusually slow, was really one of general paralysis and not of disseminated sclerosis.

REFERENCES.
[1] BRITISH MEDICAL JOURNAL, February 28th, 1920. [2] Ibid., April 3rd, 1920. [3] Ibid., April 3rd, 1920. [4] Ibid., June 19th, 1920.

A SIMPLE METHOD OF COMBINING ETHER ADMINISTRATION WITH THE VERNON HARCOURT INHALER.

BY
H. P. FAIRLIE, M.D.,
GLASGOW.

SINCE writing previously on the subject of the Vernon Harcourt inhaler,[1] advocating more extensive employment of this dosimetric method of chloroform administration, I have had considerable additional experience with the inhaler, and this has not caused me to modify the opinion expressed in that paper. It seems to me that the prevalent attitude towards chloroform, banning its use as an anaesthetic, is extreme, and that this agent still occupies a valuable place. I agree that it must be given with great care, but think dangers may be very largely discounted by the employment of the Vernon Harcourt inhaler, which limits the vapour strength to 2½ per cent.

It is often asked, Why use a complicated mechanism such as this when a drop bottle and simple mask are so much more convenient? The principle in both cases is identical, air being drawn over the surface of evaporating chloroform, taking up a percentage in passing. In reply to this the British Medical Association Chloroform Committee pointed out many years ago that the percentage of chloroform taken up from the mask and drop-bottle method is difficult of control; it may easily exceed 2½ per cent., and when this happens the danger zone is entered. Levy has attacked this view. In a paper on "Cardiac fibrillation and chloroform syncope"[2] he says:

"It is now obvious that the present-day teaching—that safety lies in attention to vapour percentages—must be permanently abandoned, but there is no reason for a violent reaction, leading to the extreme opposite practice"; and again: "The theory of death by overdosage has, in my opinion, been a most deplorable one for humanity."

The experiments on which his conclusions were based were performed almost exclusively on cats. Embley,[3] commenting on Levy's findings, suggests that experiments on cats with regard to chloroform action on the heart are misleading. Talking of ventricular fibrillation, he says:

"I have found it to occur during the administration of chloroform in three out of five successive cats, whilst out of several hundred successive dogs in which death had been caused designedly by chloroform under a great variety of conditions, I have never observed it except as a terminal process when the blood pressure had fallen very low from shock or some other cause—quite a distinct event from that form of fatal syncope in cats." And again: "The control of the cardiac rhythm in the dog is markedly vagal, and it approximates in this respect to that of the human."

Whether or not this be the explanation of Levy's theories, they seem to me to be at variance with clinical experience. In using the Vernon Harcourt apparatus the occurrence of symptoms of cardiac failure have been conspicuously less frequent than when ordinary drop methods have been employed. In those cases in which such symptoms have occurred it has been as an accompaniment of shock-producing surgical procedure, and extremely rarely, as Levy's contention seeks to prove, in the early stages of administration.

It is always advisable, however, to have ether available, and a disadvantage of the Vernon Harcourt inhaler is the impossibility of combining ether, or of changing to ether without a change of apparatus. To overcome this the following simple expedient occurred to me: I employ an ordinary Hewitt wide-bore ether inhaler, without the bag. To fit on in place of the bag attachment Messrs. Coxeter and Son made for me a metal diaphragm fitting to the distal end of the Hewitt reservoir and having a perforation cut through its centre to fit the tube of the Vernon Harcourt inhaler. The Hewitt reservoir is charged with the usual quantity of ether, and, as there is no bag and therefore no rebreathing, administers it by the open method.

In practice I induce anaesthesia by means of chloroform through the Vernon Harcourt inhaler and then introduce ether according to requirements. In cases of cardiac failure the chloroform may be shut off and ether alone administered. In my experience this combination apparatus has proved most useful.

REFERENCES.
[1] *Glasgow Medical Journal*, January, 1917. [2] *American Year Book of Anaesthesia and Analgesia*, 1915. [3] *American Journal of Surgery*, January, 1916.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

DEATH AFTER TONSILLECTOMY.

THIS note deals with a case which was under the care of Mr. Alban Evans, who kindly agreed to publication and furnished information about the clinical features of the case:

D. R., male aged 14, at puberty, was first seen at the ear and throat out-patient department of Swansea General Hospital complaining of nasal obstruction and frequent sore throat. Examination showed large and unhealthy tonsils, chronic catarrhal rhinitis, and dull, retracted tympanic membrane. Operation was advised, and the tonsils were enucleated and a large adenoid mass removed by Mr. Alban Evans. Some thyroid enlargement was noticed before the operation; neither during nor after the operation was there abnormal haemorrhage. The boy was removed to the recovery room and appeared to be doing perfectly well, when about half an hour after the operation he suddenly collapsed and, in spite of prolonged remedial measures, did not recover.

A *post-mortem* examination made next day revealed no sign of asphyxia or violence; the thyroid gland was very obviously enlarged on external view. The brain appeared normal and showed no haemorrhages of any kind. The larynx was normal, the trachea free of blood, and its lumen between the third and fifth tracheal rings was diminished about one-half by pressure from the enlarged thyroid. The sites of the removed tonsils were clear of blood clot; removal had been complete. The thyroid gland was greatly enlarged, weighing 160 grams; a cut into the gland substance showed presence of colloid secretion and some congestion. The gland had completely enveloped the trachea and compressed the posterior wall so that the lumen was crescentic in shape. Histologically, the thyroid showed an unusually large proportion of secreting cells and congestion of the blood vessels; comparison of this gland with sections of simple goitre removed at a thyroidectomy showed it to contain less colloid. The thymus gland was larger than normal, weight 57 grams; it did not exert pressure on the air passages. Microscopic examination showed apparently normal thymic tissue. The oesophagus was normal, as were also the bronchial and cervical glands. The heart, save for a moderate degree of dilatation of the right auricle, appeared entirely normal; the ventricles were in diastole. The lungs were both well [illegible]ed and free from congestion or oedema; there was no collapse of lung tissue nor other sign of respiratory obstruction or failure. The right upper lobe was slightly adherent to the parietal pleura. In the abdominal viscera the only sign of disease found was mesenteric adenitis of tuberculous type, not advanced. The stomach was empty save for a trace of swallowed blood, and the spleen, pancreas, and suprarenals looked quite normal to the naked eye.

The exact mechanism of death in this case is obscure; the leading features were:

1. Enlargement of thyroid with narrowing of trachea—possibly a late event—and enhanced activity of the gland.
2. Enlargement of thymus.
3. An "adenoid" tendency, not very pronounced.

The boy did not die of asphyxia; apparently there was cardiac failure associated with hyperthyroidism, possibly of acute onset, and with an unusually large thymus.

In the discussion on status lymphaticus held by the Royal Society of Medicine at Bournemouth in June, 1914, the opener, Dr. Hugh Thursfield, laid stress on the

probability of this condition being a disorder, not only of the thymus but of the whole endocrine system; and the discussion following indicated a possible relationship between deaths at operation for Graves's disease and deaths of the "status lymphaticus" type. From that standpoint this case is suggestive, and it has therefore seemed to me worthy of publication.

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Reviews.

FUNCTIONAL NERVOUS DISEASE.

THE volume on *Functional Nerve Disease*,[1] edited by Dr. H. CRICHTON MILLER, consists of a series of essays which serve to indicate certain aspects of the war neuroses that are of value to the medical practitioner in dealing with nervous diseases in his practice. The scope of the book may be indicated by a brief survey of its contents. In the first chapter the editor deals with the question of physical etiology, and he gives illlustrative cases to emphasize the importance of an unprejudiced attitude in approaching nervous conditions, so that neither the physical nor the emotional factors may be neglected in arriving at a diagnosis. Dr. Miller also provides a contribution on the "mother-complex," in which he shows the influence of an unfavourable home atmosphere in the development of a neurotic mental make-up. Perhaps if, instead of giving a few brief notes on a series of cases, he had described one or two cases more fully, and had indicated the relation between the early family life, the mental characteristics, and the nervous symptoms, he would have developed his argument more convincingly.

Dr. Riddoch furnishes a useful contribution on differential diagnosis, in which he urges the necessity for the formulation of general principles in relation to nervous disorder, and for their investigation from the point of view of disturbance of function. Dr. Bramwell deals with physical treatment, and suggests in a practical article both the value and the dangers of therapy conducted along the lines of rest, massage, electricity, hydrotherapy, diet, and drugs.

Dr. Prideaux compresses rather much into his article on hysteria, and its value would have been increased if he had emphasized his points by reference to actual cases. Thus, when he states that he uses "the term 'anxiety neurosis' as distinct from 'anxiety hysteria' . . . for those cases in which the anxiety is of physical origin, and is secondary to organic conditions of the viscera and endocrinic glands," he should indicate more definitely what organic conditions he refers to, and what the symptoms of anxiety neurosis are, if his classification is to be of value to the reader.

Dr. Hadfield describes his method of treatment by "hypno-analysis." His article is thoroughly practical and the points are clearly and simply indicated. Dr. Rivers provides a short but useful contribution on "Repression and Suppression." His views are, of course, well known, and they have done much to influence the treatment of the war neuroses on sound lines. Dr. Maurice Nicoll furnishes an excellent article on "Regression." This conception as to the significance of neurotic symptoms is not only illuminating, but essentially scientific; as the writer says, it "links up with the central teaching of Hughlings Jackson on dissolution in the nervous system," and also with that of Janet in his biological conceptions of psychasthenia. Dr. Nicoll also writes, in association with Dr. Young, on psycho-analysis, the treatment of this subject being along the lines of the Jung school. In two useful chapters Dr. Bryce deals with the institutional care and Dr. Culpin with the individual care of the neurotic patient.

In the concluding chapter Dr. McDougall, at the request of the editor, summarizes the various views expressed by the writers in this volume. As Dr. McDougall says, "this is a difficult and invidious task," but nevertheless he performs it successfully; not only does he clearly indicate the essential principles which the various writers illustrate, but he harmonizes in a large measure views which appear somewhat divergent. This chapter, as the editor recognizes, gives a coherence to these essays as a whole which they would otherwise have lacked with a number of writers approaching the subject of the neuroses from such different angles. The volume may be recommended to the practitioner, who will find therein much of interest and value.

[1] *Functional Nerve Disease.* An Epitome of War Experience for the Practitioner. Edited by H. Crichton Miller, M.A., M.D. London: Henry Frowde, and Hodder and Stoughton. 1920. (Demy 8vo, pp. 208. 8s. 6d. net.)

VENEREAL DISEASES.

IN his new publication, *Venereal Diseases*,[2] Mr. J. E. R. MCDONAGH has dealt with the clinical rather than the pathological side of the subject. In the opening chapter he expressly states that questions of pure pathology are beyond the scope of his present book, and will be referred to in a future work in course of preparation. At the same time, although questions of pathology are postponed for future consideration, they are never very far from the author's thoughts. Mr. McDonagh writes, it is true, of clinical matters, but the life-history of the *leucocytozoon syphilidis* crops up with some of the insistency of a King Charles's head. Mr. McDonagh writes with a purpose: he has a creed to defend, and he defends it with energy and enthusiasm. His creed is summarized at the close of the first chapter in the following words:

> I believe that the *Spirochaeta pallida* is only the adult male of a coccidial protozoon; that the complement fixation test is merely a physical reaction dependent upon the increased number and size of the protein colloidal particles in the serum; and that salvarsan only destroys the parasite indirectly by increasing the oxidizing action of the host's protective substance.

Having summarized his belief in this manner, Mr. McDonagh shows no hesitation or diffidence in his treatment of the many controversial points appertaining to his subject. Whatever the truth may be, Mr. McDonagh is undoubtedly a stimulating writer. He never shirks a difficult subject, and defends his views with considerable ingenuity. The most hostile critic would be compelled to confess that, whatever the merits or demerits of *Venereal Diseases* may be, the book is no colourless transcription of other people's views, but an original and uncompromising piece of writing.

Whilst we cannot fail to admire the author's ingenuity and originality, there is much that can be criticized in Mr. McDonagh's method of writing. However stimulating the book may be to the syphilologist, it will prove a somewhat mystifying work to the less experienced. The author rarely affords his reader any clue as to when he is discussing accepted fact and when he is indulging in speculation. Ingenious theories are so interwoven with time-honoured and attested fact, that considerable experience and knowledge are required to separate the one from the other. However plausible a theory may be it is still a theory, and should be presented as such. The author of this work repeatedly presents a theory to an unsuspecting reader as though it were a solid building resting on a solid foundation. Examined more closely by a competent critic, there is nothing to be found but a very ingenious speculation erected on a very insecure basis. It is for this, rather than for any particular opinion expressed by him, that we would criticize the author.

Mr. McDonagh is in favour of subdividing syphilis by a method other than the somewhat unsatisfactory one in common use. The primary stage is for him that period of the disease which elapses between the first appearance of the sore and the onset of a positive Wassermann reaction. The generalization stage lasts from the appearance of the positive Wassermann reaction to the time when the organisms, having spread over the whole body, become dormant; the latent stage, when the organisms are dormant; the recurrent stage, when the organisms become active again and produce lesions.

In dealing with the question of early diagnosis, the author lays special stress on the importance of clinical observation as opposed to bacteriological examination. Not only can a syphilitic chancre be distinguished from a non-syphilitic sore by careful clinical observation, but the future course of the disease can, according to Mr. McDonagh, often be prognosticated from the type of chancre present. A papulo-ulcerative chancre indicates a

[2] *Venereal Diseases: Their Clinical Aspect and Treatment.* By J. E. R. McDonagh, F.R.C.S. London: W. Heinemann (Medical Books), Ltd. 1920. (Double cr. 8vo, pp. 431; an atlas of 106 colour, and 21 half-tone illustrations. £3 3s. net.)

high resistance on the part of the host, and the disease usually runs a mild course. The papulo-erosive chancre, on the other hand, is apt to be followed by recurrences. Granulating chancres, although resistant to treatment, are seldom followed by vascular or nervous sequelae. Of the majority of cases that are published as instances of re-infection the author is very sceptical. Judging from his own experience, he believes that over 95 per cent. of such cases, occurring within six months of the cessation of treatment with arseno-benzene, are really cases of recurrence.

In discussing treatment, Mr. McDonagh advocates the use of intramine in addition to arsenical compounds and mercury. He lays special emphasis on the power of intramine to prevent such accidents of arsenical medication as dermatitis, and is convinced that the employment of this substance diminishes the risk of neurosyphilis. In the late stages of syphilis, he says, the use of intramine should always precede that of arseno-benzene and mercury.

The illustrations and coloured plates are excellent, and add materially to the value of the book. Mr. McDonagh has certainly had a very large amount of clinical material to draw upon, and has used that material to great advantage. Whatever may be the conclusion the author may have drawn from what he has seen, his work is full of useful and suggestive observations.

ANAESTHESIA.

DR. SILK'S little book on anaesthetics[3] first appeared in 1914, and the innovations which have been introduced into anaesthetic practice since that time are described in the present issue. At the same time the book has been kept to its very convenient and useful size. It certainly has no superior as a condensed view of the clinical phenomena of anaesthesia, and the means of their production. Generally speaking, the author's preference is for open ether with an addition of 3 per cent. chlorcform. In his recommendations for the management of tonsil and adenoid cases, Dr. Silk does not mention the use of open ether to an extreme degree of narcosis—a method which is now much practised in connexion with the enucleation operation deliberately performed. The author prefers to keep the swallowing reflex, and maintains anaesthesia with chloroform from a Junker's inhaler after an ether induction. He gives an illustrative and short account of recently introduced apparatus for prolonged nitrous oxide and oxygen anaesthesia, but does not appear very enthusiastic over it, either for general surgery or in its nasal form for dental extractions. He approves, however, of gas and oxygen for empyema operations, and gives interesting figures showing the danger of these cases. These statistics were obtained by Dr. Silk in his official capacity as consulting anaesthetist in the army, and though not very extensive are of much value. We are interested to see that the author dissents from Crile's view that general anaesthesia "protects none of the brain cells against exhaustion from the trauma of surgical operations," and believe that he is in the right. Dr. Silk is in favour of morphine and atropine before operations, but believes that scopolamine increases rigidity and post-operative depression. This edition is likely to repeat and increase the popularity of its predecessor.

Dr. BARTON, in this small book of essays,[4] touches on matters generally left out of textbooks on anaesthetics. This and a purposely unconventional manner of describing usual things give the book an attraction of its own. Thus the reader will be held early in the book by "emoluments" in thick print, closely followed by the "lure of anaesthetics" in equally emphatic type. He will find himself descending "shoals and rapids" in the author's company in order to reach with him the "haven" of safe anaesthesia. The author's views in the main depart nowhere widely from those commonly held and practised by the anaesthetists of to-day. He has, however, designed an apparatus for the administration of ether which he has used with success for many years, and of which he gives a clear description and illustration. He likes to precede ether by CE mixture and ethyl chloride, both given on an open mask, which is afterwards replaced by his own inhaler with ether. Many useful practical hints are given as to apparatus and the transport of anaesthetics, as well as good directions for the actual use thereof. One or two well described cases illustrating common difficulties and dangers are as good as anything in the book. A very good little summary is given of the explanation of sudden deaths under chloroform in early stages of narcosis, and Dr. Barton accepts whole-heartedly Levy's views on fibrillation. The author in his preface refers to "commencing and occasional anaesthetists," but we believe his book will be even more valuable to those who have already had considerable experience in the matters of which he treats.

[3] *Modern Anaesthetics.* By J. F. W. Silk. M.D. Second edition. London: E. Arnold. 1920. (Cr. 8vo, pp. 203; 37 figures. 7s. 6d. net.)

[4] *Backwaters of Lethe.* By G. A. H. Barton, M.D. London: H. K. Lewis and Co., Ltd. 1920. (Cr. 8vo, pp. 157; 9 figures, 2 plates. 5s. net.)

THE MICHELL CLARKE MEMORIAL VOLUME.

As professor of medicine, as pro-vice-chancellor, and in many other ways, J. MICHELL CLARKE, whose lamented and premature death occurred in 1918, took a prominent part in the organization of the University of Bristol. It is therefore most appropriate that part of the memorial to this devoted worker should take the form of a collection of seventeen selected papers[5] from his hundred published contributions. This task has been carried through by Drs. G. Parker and J. M. Fortescue-Brickdale, who in a prefatory note refer to the difficulty in making the selection of the reprints. There are nine papers on general medicine and eight on various aspects of neurology—a subject in which Michell Clarke was specially interested. A complete bibliography of his writings is also given, and shows that sixty out of his hundred contributions were on diseases of the nervous system. A short biographical memoir is reproduced from the *Bristol Medico-Chirurgical Journal*, in which thirty-two of his published papers originally appeared. One of the earliest of the reprinted papers, that on Huntington's chorea, appeared in *Brain* in 1897, and the latest, on trench fever, in the BRITISH MEDICAL JOURNAL in 1917. The more important of the other papers are his Bradshaw Lecture for 1915 at the Royal College of Physicians of London, on the nervous affections of the sixth and seventh decades of life, the presidential address to the Bristol Medico-Chirurgical Society in 1905 on the relation of medicine to natural science, and the Long-Fox lecture for 1911 on cerebro-spinal syphilis. There are also interesting papers on degeneration of the spinal cord in anaemia, and on the special features of pernicious anaemia in persons older than those usually attacked. Recurrent and transient paralysis engaged Professor Michell Clarke's special attention, and his paper on recurrent motor paralysis in migraine contains the history and genealogy of a family in which hemiplegia and, as a rule, loss of speech, accompanied attacks of sick headache.

VITALISM.

SIR BERTRAM WINDLE'S *Vitalism and Scholasticism*[6] is an expansion of his work *What is Life? A Study of Vitalism and Neo-Vitalism*, published in 1908, and is concerned with the nature of life and of living things. The old scholastic conception of the vital energy of the living body was seriously attacked in the second half of the nineteenth century by Lotze, Huxley, Burdon-Sanderson, and Le Dantec, who taught that all the manifestations of life can be explained in terms of chemical equations and physical experiments. The object of this book is, first, to set forth the arguments of the neo-vitalists who disagree with this mechanical conception, and secondly, to show the relations between the scholastic vitalism and the modern views, such as those of Dr. B. Moore, whose "biotic energy" appears to be identical with the vital principle of scholasticism. With this end in view the author has brought forward the biological evidence available in favour of a vitalistic or neo-vitalistic explanation of living matter. The question of the human soul and its relation to the activities of the human body—a subject for theologians rather than for biologists—has been touched on incidentally only. The argument is clearly stated, and can be readily followed by a reader without any biological training.

[5] *Neurological and other Papers.* Reprinted from the writings of John Michell Clarke, M.A., M.D., LL.D., F.R.C.P. Bristol and London: J. W. Arrowsmith. 1920. (Pp. 263. 10s. 6d.)

[6] *Vitalism and Scholasticism.* By Bertram C. A. Windle, M.A., M.D., Sc.D., LL.D., F.R.S., F.S.A. London: Sands and Co. 1920. (1 p. 256; 5 figures. 8s. 6d.)

NOTES ON BOOKS.

IN writing the *Life and Work of Sir Jagadis Bose*,[7] who was this year elected a Fellow of the Royal Society, Professor PATRICK GEDDES has been actuated, not only by admiration for the first Indian of modern times to do distinguished work in science, but by his interest in raising and maintaining the professional standard and ideal above and beyond racial differences. This biography is, indeed, also a sociological study with the object of encouraging science students, especially in India, to overcome difficulties, and so follow the example successfully set by Sir Jagadis Bose. Born in 1858 in Eastern Bengal, and attracted to physics by the teaching of Father Lafont, professor in St. Xavier's College, Calcutta, Bose came to England with the object of studying medicine; but, as ill health rendered this inadvisable, he went up to Christ's College, Cambridge, and eventually, armed with science degrees from London as well as Cambridge, returned to India to take up teaching and research in physics. After considerable initial difficulties, he settled down to work and carried out further researches on Hertz's electric waves with results which met with warm approval from Lord Kelvin. Subsequently the electric response of inorganic and living matter engrossed his attention. A full account is given of the experiments on plant response, and there are good illustrations of the magnetic crescograph for magnifying ten million times the growth of plants, and of graphic records of those movements. These ingenious researches on the borderland of physics and physiology, which have attracted much attention, were followed by investigations in psycho-physics; and, though he retired as an Emeritus Professor in 1915, not only has he continued to work, but the Bose Institute for research in pure science will be a permanent memorial of this Indian pioneer.

A short but admirably written life of *Florence Nightingale*, by Miss ELEANOR FRANCES HALL,[8] appropriately appears in the "Pioneers of Progress—Women" on the hundredth anniversary of the birth of the "Lady with the Lamp." It is dedicated to the memory of Dr. Elsie Maud Inglis, "whose Crimea was Serbia, but whose post-war work is in another world," and whose life's story is told in a companion volume of this series. The difficulties that Florence Nightingale had to overcome the conventional prejudice against devoting herself to nursing at a time when Mrs. Gamp was no fancy picture, and the preparatory training that she accomplished at Kaiserwerth under Pastor Fliedner and as postulant among the Sisters of Charity in Paris, are well and sympathetically sketched. After a graphic account of her work at Scutari, her successful labours in reforming the army medical service, hospital nursing, and Indian sanitation are described; and the concluding chapter, entitled "The Lamp Within," sums up her long life and the changing phases of her many-sided temperament.

The principles and practice of Continental therapy by baths, waters, and climate are set out in full detail in the large textbook of STRASSER, KISCH, and SOMMER, recently published in Vienna.[9] The book is full of information, and may be recommended to medical men requiring a treatise on the subject.

Baillière's Nurses' Complete Medical Dictionary[10] is a serviceable little book, fairly complete, clearly written, and well printed, that may be recommended to nurses and members of the lay public who want a small dictionary of terms in common medical use.

[7] *Life and Work of Sir Jagadis C. Bose, C.I.E., C.S.I., M.A., D.Sc., LL.D., F.R.S., Emeritus Professor, Presidency College, Calcutta.* By Patrick Geddes, late Professor of Botany (University College, Dundee), St. Andrews University, and Professor of Sociology and Civics, University of Bombay. Longmans, Green, and Co. 1920. (Pp. 253; 9 plates, 23 illustrations in the text. 16s.)

[8] *Florence Nightingale.* By Eleanor Frances Hall. In "Pioneers of Progress—Women," edited by Ethel M. Barton. London: Society for Promoting Christian Knowledge; New York: The Macmillan Co. 1920. (Pp. 84; 4 illustrations, 1 map. Price, cloth 3s. 6d.; paper 2s. 6d.)

[9] *Handbuch der klinischen Hydro-, Balneo-, und Klimato-therapie.* By Professor Dr. Alois Strasser, Dr. Franz Kisch, and Professor Dr. E. Sommer. Berlin and Vienna: Urban and Schwarzenberg. 1920. (Sup. roy. 8vo, pp. 920; 48 figures. M. 210; Geb. M. 270.)

[10] *Baillière's Nurses' Complete Medical Dictionary.* Edited by Constance M. Douthwaite. Second edition. London: Baillière, Tindall, and Cox. 1920. (Cr. 16mo, pp. 214; 3s. net.)

THE Hufeland Society of Berlin has chosen as a subject for the Alvarenga Prize for 1921 the etiology, symptomatology, and morbid anatomy of lethargic encephalitis.

MOTOR NOTES FOR MEDICAL MEN.

By H. MASSAC BUIST.

RISING FUEL COSTS.

OWING to the increasing cost of materials, workmanship, and so forth, not a few medical men who have returned from the war and who formerly were owners of cars have equipped themselves with motor bicycles. The latest increases in the cost of motor fuel, however, have rendered the operation of these lighter machines as costly in respect of fuel consumption as were small cars before the war. Nor has the worst phase of the matter been reached. In America a gallon of petrol costs about 2s. 1½d. But it is certain that, unless consumption can be reduced there, of which there is no prospect, the cost will be raised very soon. To-day America is consuming 2,000,000 more gallons of petrol than she can procure, so the reserves are lower than at this period last year. Moreover, she has a million more motor vehicles in use to-day than she had a year ago. In this country we are paying 4s. 3½d. a gallon for No. 1 spirit, which is scarcely superior to No. 2 spirit before the war. On the other hand, in France something over 12s. a gallon is paid for petrol. The diatribes levelled against the vendors of motor fuels in this country are chiefly on the lines of accusing them of profiteering, and showing how their revealed profits have increased since the outbreak of the war, but no reference is made to increased turnover and the other branches of these firms' enterprise. Such analyses are quite unsatisfactory, because these corporations all trade in various parts of the world. I am satisfied they could prove that they would be much in pocket if they ceased selling motor fuel in this country, and disposed of all they could secure in markets overseas. Nor must it be forgotten that large carrying corporations, such as the London General Omnibus Company, are supplied with fuel on long contracts which were working out at a loss of several pence a gallon before this increase of price, so that there will be over a shilling a gallon loss now. Likewise no serious attention need be given to the declaration by the Motor Fuel Committee, in its interim report of February last, that prices charged were too high, and so forth. The motor fuel business is a most intricate affair.

What it Means to the Doctor.

Instead of being concerned with propaganda, the medical man is interested in getting the facts as they bear directly on the running of his own motor vehicle for professional purposes. The plain fact is that there is more demand for motor fuel than world production can satisfy; that America owns 80 per cent. of the world's production of motor fuel, and controls some 50 per cent. of the balance; that the British Empire does not produce more than 2 per cent. of the total world's demands for fuel; and that we do not control more than another 4 per cent. Consequently what we pay for fuel in this country is dependent on the price at which the controllers, otherwise the United States, care to fix, and on the exchange. Certainly we have not come to the worst of the motor fuel situation in this country. This is the serious thing for the medical man, for already, if his motor vehicle runs thirty-four miles to the gallon of fuel, it will cost him 1½d. a mile. This has to be taken, too, in conjunction with the high cost of tyres and repairs. The majority of doctors consider themselves lucky if their cars will run twenty-three miles to the gallon, which represents 2¼d. a mile. Those whose vehicles will do only seventeen miles to the gallon are paying 3d. a mile for their fuel. But the current prices, on which these calculations are made, will not obtain six months hence. On the contrary, as far as can be foreseen, we shall pass the 5s. mark, and even approach 6s. a gallon. But that would be a passing phase only. If British public opinion makes it too unpleasant for the petrol traders, who in this country are not masters of the situation, being themselves in the hands of the United States controllers, then the traders with establishments here will not trouble to bring the fuel to this country, but will sell it where they can get even higher profits. Fortunately the Government seems really intent on doing everything possible to develop the empire's motor fuel supplies rapidly, because it realizes already that the coal situation is such that 25 per cent. of the ships fuelled in home ports take

oil. The Government estimate is that in ten years' time at least 80 per cent. of such vessels will be supplied with oil fuel. Of course we can never discuss petrol without considering the oil industry, whence it is derived; even as it is idle to inquire why we are not pushing benzol production more when we have periodical troubles with the coal industry. It may be answered that shale will give us the benzol we need; but, though we develop the production from Scottish shale, all such increase would barely suffice for all the needs of the navy. The Government has always taken the output from these sources; consequently, as far as the public is concerned, if benzol is to be had at all, it must continue to come from coal. Benzol, therefore, is only a less practicable form of relief at the moment than is power alcohol, which is at present in the purely experimental stage, and will take longer to develop to a commercial scale than will the oil resources of the British Empire. Vast sums of money are being employed in exploiting possible oil supplies; there is no limit to them. All that is necessary is for other departments of the Government to assist the work of the Minister for Petroleum Affairs by rendering the thing profitable for those who are successful, and not to kill enterprise either by limiting or taking too much of the profits. This problem is closely bound up with human nature. No one likes paying exorbitant petrol bills. Probably most people consider themselves foolish not to have put their savings into the oil industry. Be that as it may, when it comes to motor fuel the only thing to do is, not to complain vainly—that will work no cure—but to weigh up the facts in their various bearings.

Causes and Remedies.

We are going through a very bad time, not only in this country, but throughout the world. The petrol demand will be greater than ever, because, despite something in the nature of a slump in the demand for motor vehicles, particularly of the utility sort, it must be borne in mind that quantities of parts have been manufactured, but are not yet assembled, consequently there is a bigger output to be absorbed by the buying public from the world's motor factories in general than they have yet actually delivered for sale. Moreover, works can dismiss hands wholesale, as is obtaining on the Continent as well as in America; still the output from the factories will not fall off, but will increase for several months to come, by reason of the fact that the parts of tens of thousands of vehicles are made already. When hands are turned off they are taken from those operations which are the preliminaries of manufacturing. Hands concerned with the final stages of building—assembly—are kept on. In addition, there are all the war vehicles to absorb. Then we have the practical steps taken by the London General Omnibus Company to tackle the problem of reducing vehicle weight per passenger carried. It is now known that the new style, K type, omnibus has proved itself and is coming on to the streets of London in quantity. But it is not so generally known that for every new style bus so placed on the streets an old "Red General" B type is available, thoroughly overhauled, for £500, completely fitted with body to hold thirty-four, or at £450 for the chassis. These vehicles will be eagerly sought after, and will make yet a further demand for petrol. Therefore let nobody suppose that the arrival of the inevitable slump in motor vehicle building will mean that less motoring will be done and, therefore, that the fuel situation will be eased. It will not. Slump or no slump, there will be more motor vehicles in use every year for the next ten, at least. Nor may we overlook agricultural motoring. Fortunately, however, that is tending gradually to develop a demand for the residuary products of treating crude oil, because more and more of these machines are being made to run on paraffin.

The Efficiency Aspect.

What we are really awaiting is for the tremendous impetus that is being given to the opening up of the oil resources of the world to begin to bear fruit. Probably we shall not come for four years to the point when fuel prices will fall. But it is unthinkable that the motor movement, and the medical man in particular, must be held up on that account. All that it can mean is that something in the nature of a slump in car production will arrive more quickly than otherwise would be the case, because the situation is grossly aggravated by the high prices of cars, and the high running cost of motor vehicles according to the systems on which we build them—which leads at once to a remedy. Hitherto we have concerned ourselves with studying carburation; but that is only one way to achieve fuel economy. Much more has been done in that direction in this country than in America. But the typical British engine, with which fuel economy is achieved to a very high degree, is much more difficult to start than a typical American machine, wherein the carburetter has a pool of petrol always available. Consequently the latter will start at about fifty crank-shaft revolutions a minute against anything from 75 to 150 on a typical economical or high efficiency British or French engine. Why, however, be content with engine and carburation development, as we have been doing? Admittedly, with so-called light cars it is possible to run thirty to forty miles to the gallon on the average road; though that is not general in a doctor's service, because the car is apt to get cold in the long waits between relatively short runs, so that it rarely gets warmed up sufficiently. As a fact, it is agreed that sometimes a little more than half the fuel consumption in question is obtained in ordinary service. In this connexion there is no need to raise the old controversy as to the wisdom of using a mixture of the same richness whether the engine is running under a light or a heavy load. It is an incontrovertible fact that 1 lb. of air will burn completely 0.065 lb. of petrol. It cannot burn more. If more is fed, some will pass through the engine unburnt, or, at least, only partly burnt. If not enough heat is supplied under certain conditions of operation to vaporize the heavier constituents of the fuel, then a carburetter giving a richer mixture for that condition of operation may be of advantage from the standpoint of power. As regards economy, however, the proper remedy is to supply enough heat to vaporize all the fuel, and not to feed an excess of petrol. The two chief reasons for lack of economy in the use of motor fuel at present are that the engine is usually operated under a relatively light load, and that light load operation with the four-cycle, throttle-controlled engine corresponds to operation at low compression, which is an uneconomical condition. Again, the heavier constituents in the fuel are not reduced to the gaseous state before the explosion occurs; therefore they pass through the engine unconsumed. But we may leave it safely to our automobile engineers to continue making a reasonable amount of progress here, in spite of the fact that the falling quality of fuel tends to be less favourable to economical operation.

The Root of the Trouble.

The central fact—which also gives the likeliest hope of early relief—is that not one-third of the power generated by the engine is delivered in the form of propulsive effort where the tyres make contact with the road. In short, the whole transmission mechanism of a motor vehicle is extremely wasteful. Add to this the fact that there is not a motor car on the market which weighs less than 4½ cwt. for each passenger it is designed to carry, and it will be appreciated that there is here a vast opportunity to cut fuel consumption down to less than half. Halve the fuel bill, and 4s. 7d. aviation spirit becomes 2s. 3½d. a gallon, which is bad enough, but certainly a notable relief to present cost.

It is scarcely possible to conceive more adverse circumstances than those that obtain in regard to motoring at the moment and those which are in close prospect. But their synchronization gives a ray of hope. The situation is so bad that every form of enterprise concerned must perforce apply itself to remedies. On the one hand, the oil resources of the world are being exploited to an extent that has never obtained before; on the other, we see that, if the manufacturers are to have a chance of continued trade, they must seriously tackle the problem of reducing vehicle weight per passenger carried, also of economizing power in transmission. There must be more motoring for less fuel expenditure. In measure, too, as this effort is related to the task of reducing vehicle weight, it means, of course, less tyre expenditure. Meantime, there is nothing for the British medical man but to grin and bear it, and, above all, to keep very careful note of his expenses under these heads, claiming them when making his income tax return.

British Medical Journal.

SATURDAY, SEPTEMBER 18TH, 1920.

THE MEDICAL PROBLEMS OF FLYING.

THE development of our flying service during the war raised problems which called urgently for experimental physiological work: the maintenance of mental and physical efficiency at high altitudes, the detection of the signs of flying fatigue and strain, and the working out of methods for selecting candidates for commissions, all demanded investigation. In March, 1918, the Air Medical Investigation Committee took up the work of previous committees, and in *The Medical Problems of Flying*[1] the Committee presents the results of "team work" in which the physiologist, the physician, the neurologist, and the psychologist each took his share, whilst in the background was the squadron commander ready to check their observations by his own.

The first subject for consideration was the use of oxygen. Before the war Martin Flack and Leonard Hill had shown the advantages of its administration before, during, and after a period of exertion, and its use at great altitudes was an obvious necessity. Those airmen who at first scoffed at it became its keen advocates after practical experience, and as time passed oxygen was used in increasing amount, the administration being continuous by a specially devised apparatus. Dyspnoea, muscular weakness, and syncope were to be expected at great altitudes; but Dr. J. L. Birley describes a transitory impairment of judgement and perception as a more serious and subtle danger, since in many cases the pilot cannot be convinced of its occurrence. In order to study these conditions of oxygen-want, Professor Dreyer devised a breathing apparatus in which, by diluting the air supply with nitrogen, not only the cardio-vascular and respiratory changes, but even the sensations and symptoms experienced under actual flying conditions, were so closely reproduced that skilled pilots could estimate accurately the artificial altitude to which they were being exposed. Using this apparatus Dr. H. C. Bazett and the late Dr. C. D. H. Corbett were able to classify pilots and observers in regard to their fitness for different altitudes. Working towards the same end, Lieut.-Colonel Martin Flack demonstrates how the observations of experienced officers on the fitness of individuals are confirmed by physiological investigations directed to their vital capacity, expiratory force, time of holding breath, and of sustaining 40 mm. of mercury by blowing in one limb of a U tube, as well as to their cardio-vascular responses and neuro-muscular stability. This applies both to candidates for commissions and to the subjects of flying fatigue and stress. As would be expected, reaction-time tests showed a similar correlation between laboratory results and actual experience.

Dr. Henry Head, in his contribution on "The Sense of Stability and Balance in the Air," takes us to the borderland of the mental and the physical. He rejects the current explanation of such evidence as tremor of the hands, inability to balance a rod on a flat board with eyes open or shut, or to stand on one foot with eyes closed, which had hitherto been regarded as indicating "nervous instability," "vestibular instability," or "want of muscle sense," and regards them, in the men under consideration, as revealing simply the condition of physiological or psychical control. Such control, he says, may be defective from various causes; some of the most potent are fatigue, physical or mental stress, anxiety and fear. This offer of alternatives—the physical and the mental—indicates the general trend of Dr. Head's observations, and he points out not only how identical stimuli produce more powerful reactions in some people than in others, but that in the same individual the effects of the stimuli vary greatly with his mental state. He gives an example of purely mental lack of control in a man who, when rotated five times in a chair (ten rotations being the usual test), became so giddy that he "sat coiled up clinging to the arms of the chair, unable to move"; in this case the profound reaction to change of posture was one aspect only of a congenital want of nervous control in a man of unusual physical strength and athletic ability. An unexpected distinction is found between "fainting in the air" and giddiness with nausea and vomiting. Fainting is associated with a natural resistance to vertigo, and may be produced by excessive rotatory stimuli, but it may arise during normal flight at low altitudes, when it is evidence of diminished general resistance. Giddiness and nausea, on the other hand, occur in pupils on their first flight, and may disappear as facility in the air is acquired; but when central control is diminished regression takes place and the symptoms reappear. This regression to some previous habit or less efficient form of mental activity, when control by a higher centre over a lower is lost, is a well known physiological law. In such regressions Dr. Head would seek the explanation of certain apparently incomprehensible accidents in the air.

Dr. Birley's study of "Temperament and Service Flying" is intermediate between the physiological aspect, as examined by Colonel Flack, and the more psychological views of Dr. Head. That the point of view affects the conclusions of the observer is shown in Colonel Flack's tentative hypothesis—that the first stage in the onset of flying fatigue is due in many cases to an altered tone of the respiratory centre, which, by a lessened oxygenation of the body, reacts upon the circulatory and nervous systems; Dr. Birley, on the other hand, taking for granted that emotional disturbances are readily reflected in the circulatory apparatus, concludes that "a study of the pulse rate and blood pressure, together with the manometer tests, affords valuable information in assessing temperament and an individual's susceptibility and reaction to mental trauma." In an appendix on "Wind-up," by Dr. W. H. R. Rivers, is discussed the purely psychological aspect of unfitness arising from mental causes. Other contributors have dealt with the physiological accompaniments of fear; here the fear itself is studied, and the medical officer is given advice on the handling of the early stages of the anxiety-neurosis in warfare. Dr. Rivers gives the assurance that there is no other department of medicine in which a medical officer can gain results so definite.

The report is a valuable summary of experiment and opinion which will find application in other spheres where the personal element is of first-rate importance. The enlargement of the research to include the wider field of war service generally would have had a double advantage; the final number of cases of nervous breakdown—shell shock, hysteria, or neurasthenia—could have been diminished by combined physical and psychical examination along the

[1] Medical Research Council: Special Report Series, No. 53.

lines here laid down; in addition, the investigators themselves would have escaped a possible fallacy. Colonel Flack describes symptoms and signs as directly due to prolonged air work at various altitudes; he puts them in three overlapping groups—the cardio-respiratory, the nervous, and the muscular. The first seems identical with that known in the army as "disordered action of the heart" (a phrase the Committee has rightly avoided); the second corresponds with the army group of "neurasthenia"; and the third may be represented by some of the numerous hospital admissions under the heading of "myalgia." If, as appears probable, the army cases and those of the Air Force present an identical symptomatology, then to ascribe the latter to prolonged air work unduly narrows the value of some of the investigations. Since two of the members of the Air Committee are on the newly formed Departmental Committee on Shell Shock, we may expect that the experience already gained will find further application.

AN AMERICAN VIEW OF THE NATIONAL INSURANCE SCHEME.

THE degree to which the State should interfere with the freedom of the individual to act in his own way, so long as he does not violate the common law obligation that he shall not be a nuisance to his neighbour, is a question of public policy on which there are two schools of thought. One, dominant, or at least most vocal in this country to-day, favours increased centralized control. To those of a different opinion, as most Englishmen were, and perhaps still are, the active propaganda for State control in many directions marks a decline of those qualities that made the country great. Sound criticism of any scheme of State control is therefore sure of an audience in this country.

Mr. Frederick L. Hoffman, LL.D., statistician to the Prudential Insurance Company of America, in a Preliminary Report on the Methods and Results of National Health Insurance in Great Britain,[1] has missed his mark. His report shows that the result of his visit to England last year to study the insurance scheme has been to give him a very poor opinion of it. The Insurance Act was an experiment in State socialism, and it is not surprising to find an American condemning it, for socialism in any form is repugnant to the principles on which the Great Republic was founded. At the same time it ought to be possible to differ, even about State socialism, without losing one's temper and imputing motives. Those who look on the Insurance Act as a retrograde measure are yet ready to recognize that Mr. Lloyd George quite sincerely believed it would do good, and to admit that in forcing it through Parliament he rather endangered than consolidated his own political position. Nor is it reasonable to say that Germany, like the tailless fox in the fable, having found its insurance system a burden and a failure, set to work to induce other countries to burden themselves in the same way. Moreover, it is not true that Mr. Lloyd George made no independent inquiry into the German system. Such an inquiry was made, and some of the objectionable features of the German system were avoided. On the other hand, it is to be admitted that Dr. Hoffman is right in saying that the cost of the insurance scheme is a burden on industry. It would be difficult, if not impossible, to devise a tax that was not; this, in its greater part, is a direct tax, and therefore the less likely to be popular. Dr. Hoffman has justification for his contention that it would have been a wiser policy to attempt to remove one conspicuous cause of ill health by instituting ten years ago the housing policy which is now being pressed. In this matter the conscience of the medical profession is clear; it did all that was possible to make the facts known to the country, and succeeded in inducing Parliament to legislate, but in a hesitating, half-hearted way.

We are prepared, then, to grant Dr. Hoffman a good deal, but he overstates his case and makes himself slightly ridiculous when he says: "Viewed from the social, the medical, or the economic viewpoint, social insurance must needs undermine the foundations of government, and lead ultimately to the disintegration and bankruptcy of a State."

At the time of its introduction the majority of the medical profession was opposed to the insurance scheme, believing that things would be better without it; but when it became law those who accepted service under it acted in accordance with the tradition of the profession to do the best possible for the individual patient. Dr. Hoffman, however, is so anxious to condemn compulsory State insurance that he does not hesitate to make odious charges, not only against its authors, but against everyone concerned in its administration. In particular he attacks the panel practitioners in a way that is wholly unjustifiable. He says: "A vast amount of false certification or wrongful certification prevails, as disclosed in countless cases by investigations made by medical referees, who often find that a large proportion, *rarely less than one-half of the persons seen*, are fully able to return to work." Mistaken certification is inevitable under any system, but such a reckless exaggeration as that contained in the words in italics suggests a serious doubt as to the author's reliability and fitness for the task he undertook. Elsewhere he speaks of the "lightning diagnosis" of the panel doctors which makes proper treatment out of the question, and as evidence of their degeneracy quotes the inquiries held into alleged violations of rules and regulations, neglect of patients, and so on. Such cases, he says, have been numerous, but as a matter of fact, considering the enormous work of over 14,000 doctors, the number has been small, proving, if proof were necessary, that the vast majority of doctors on the panel do that work conscientiously and well.

Much is made of the inadequacy of the benefits under the Acts—medical, sanatorium, maternity, sickness, and disablement—and nobody would venture to deny this; but Dr. Hoffman professes to be troubled to distinguish between these benefits and Poor Law relief. The Insurance Acts have at any rate the merit of compelling the unthrifty to contribute. Much of the insurance scheme was experimental, but would not a State medical service be experimental? The author's own scheme is: "All incapacity for work, whether because of economical or medical conditions or on moral grounds, should be provided for under the direction of the State on the basic principle of continuance of part-time wages for a stated period of time." Such a scheme could hardly reach the stage of experiment, and the suggestion makes it difficult to understand what the author's economic opinions really are.

Of sanatorium benefit Dr. Hoffman says that the allowance is to an increasing extent turned over in its entirety to the local board of health, and administered jointly on behalf of the insured and uninsured population; he thinks it unjust that the insured should receive only the same kind of treatment as the

[1] *An Address on the Methods and Results of National Health Insurance in Great Britain* (Preliminary Report). By Frederick L. Hoffman, LL.D., Third Vice-President and Statistician, the Prudential

uninsured who have paid nothing towards their treatment. He knows that the insured are entitled to free domiciliary treatment, but dismisses it with the remark that it is "practically outdoor relief in the guise of health insurance." He asserts that if an insured person's means are ascertained to be sufficient his application for treatment in a sanatorium is refused. We doubt the truth of this assertion; the chairman of a sanatorium benefit committee in an industrial area tells us that he has never known or heard of such a case; that local health committees having contracts with Insurance Committees give preference to insured persons on the waiting list for admission to a sanatorium, so far as is compatible with the physical condition of the patients; and that it is quite common for a health committee to be treating in its sanatorium a greater number of insured persons than the Insurance Committee pays for. "Sanatorium benefit" was a bad term, but the insured can claim sanatorium treatment free, with the common-sense proviso that the medical adviser of the committee considers the applicant's disease to be in a stage suitable for such treatment. The element of truth in the author's strictures is that sanatorium accommodation throughout the country is insufficient, and the more progressive health authorities have been supported and the more backward authorities stimulated by the insistent demands of the Insurance Committees for more sanatorium accommodation. We are, of course, not now discussing the difficult problem whether the conception of the treatment of pulmonary consumption in sanatoriums is sound or not; it has without question disappointed many hopes; we are concerned only to show that, for what it may be worth, it is available to insured persons.

Dr. Hoffman has been industrious in collecting opinions and facts. But the opinions appear to have been all of one colour, and his facts are in some instances incomplete and in some others misinterpreted. This is unfortunate, for the insurance scheme is far from perfect, and impartial criticism founded on a careful examination of all the facts would have been valuable.

OCCUPATIONAL THERAPY.

THE paper by Dr. T. L. Llewellyn published at p. 434, though primarily addressed to employers and workmen, relates an experiment the success of which is of great interest to medicine. In all industries accidents occur and conditions prevail which frequently produce disability, but in any one place at any one time they are relatively few. In the aggregate, however, the number of persons so disabled probably to-day equals, if it does not exceed, the number disabled in the great war. The war has taught us a great deal about the treatment of the results, physical and mental, of injuries; it produced a large number of disabilities in a short time, and the disabled were congregated eventually in special hospitals, so that opportunities were afforded for intensive study. A great deal was learnt from the orthopaedic surgeons with regard to the surgical treatment of injuries of bones and joints by operation or manipulation, but it was also seen to be of great importance to stimulate the patient's mind to take interest in his own recovery. To teach a disabled man a trade, or to encourage him to work at his own, was proved to be not only good for his mind, but directly curative of physical defects.

Dr. Llewellyn describes the working of an orthopaedic or massage centre established and maintained by the employers of the coal and iron industries of North Staffordshire for the free treatment of injured workmen in receipt of compensation. The equipment was simple and the staff small, but 491 cases were treated during the first year, and satisfactory evidence that the scheme was approved by the men is afforded by the fact that the number of patients increased from 181 in the first six months to 310 in the second six months. Massage, electricity, and apparatus for exercises were supplied as part of the equipment, but the importance of obtaining the intelligent co-operation of the patient was fully recognized. The object of the treatment was explained to him, and on his first visit successful cases were brought to his notice. He was also taught exercises which he could repeat at home. The general result was very good: out of 446 completed cases, 425 returned to work, but not always the same work as they had been doing before their accident.

Rules and regulations often make it difficult for a man unable to return to his old trade to obtain a job better adapted to his altered and diminished efficiency; often also they stand in the way of the therapeutic use of work. Professor E. L. Collis of Cardiff, in a paper on the psychology of industrial convalescence, read at the recent meeting of the British Association in Cardiff, pointed out that experience with convalescing disabled soldiers had proved that few disabilities rendered a man completely incapable of doing work of some sort. The same experience made it clear that treatment suitable for such men must have an occupational objective, because occupational therapy has not only a direct effect, but a powerful psychological influence. Similarly the lessons learnt in the treatment of war neurasthenia can be applied to industrial neurasthenia, which plays, as Professor Collis says, an important part in every illness that befalls a worker, whether due to accident or disease. Professor Collis argued that the convalescence of a worker would be helped by his readmission to work for part time under medical supervision. The injured or sick man has to regain his confidence in himself and in the future, and a moral obligation rests upon an industry to provide all the necessary facilities for his proper treatment, the cost being met by the employers, and the workmen agreeing to give opportunity for occupational therapy. The effort in this direction made by the employers in Staffordshire is a move in the right direction, and is, Dr. Llewellyn says, much appreciated by the workmen; but from what has been said above it will be understood that such a centre alone will not do all that is possible, and that intelligent co-operation along the lines suggested by Professor Collis is also necessary.

THE COAL FIRE.

IN the report of Lord Newton's Departmental Committee[1] comment was made on the absence of full and scientific knowledge of domestic heating. The committee suggested that "the whole subject of hygienic and scientific heating deserves a very much greater measure of public attention than it has hitherto received." The Fuel Research Board has now published, under the title of *The Coal Fire*,[2] a special report of an investigation which has in this connexion a very considerable value. It was made by Dr. Margaret White Fishenden under the auspices of the Manchester Air Pollution Advisory Board, and was aided by grants from the Department of Scientific and Industrial Research. Dr. Fishenden's work was first directed to an estimate of the comparative heating

[1] BRITISH MEDICAL JOURNAL, August 7th, 1920, p. 220.

[2] *The Coal Fire.* A Research by Margaret White Fishenden, D.Sc., for the Manchester Corporation Air Pollution Advisory Board. Fuel Research Board Special Report, No. 3. London: H.M. Stationery Office. 4s. net.

efficiency of various types of coal grates, the older types of which, it had often been suggested, were more wasteful than others. It was found, however, that the total amount of radiant energy thrown into a room from coal or coke fires burning in open grates varied very little with the type of grate employed. The radiant efficiency, or the percentage of the total energy of combustion of the fuel consumed, which enters the room as radiation varied in different grates from 19½ to 24 per cent., and the figures referring to old-fashioned grates with bars in front were, indeed, slightly higher than those obtained from modern barless grates. By crushing the coal into slack its radiant efficiency was diminished by about one-sixth. Both Welsh anthracite coal and dried gas coke were found, weight for weight, to give some 4 or 5 per cent. more radiation than was furnished by coal. Low-temperature carbonization cokes were remarkably efficient as radiant sources, having 31 to 34 per cent. radiant efficiency compared with 24 per cent. for coal in the same grate; the fires from these fuels were easily lit and free, in combustion, from both smoke and smell. The reason for the high relative efficiency of this fuel is obscure—it may perhaps be found in its peculiar porous structure, with a relatively large area of exposed surface. Whatever be the explanation, support is afforded to those "smoke reformers" who have advocated that a fuel of this nature should be put on the market at a reasonable price. Several preparations widely advertised as doubling the value of a ton of coal were examined; these consisted generally of common salt with a small proportion of other chemicals, and in no instance had they any effect on the quantity of heat yielded by a given weight of coal. Dr. Fishenden devoted much attention to the effect of variations in draught, and a further study of the whole question of draught in connexion with coal fires is contemplated. As draught was reduced a smaller portion of the heat was found to be wasted in gas leaving the chimney; the amount so saved is absorbed by the walls and is given out into adjacent rooms or possibly to the outer walls (hence a fireplace should never be placed on an outside wall). Excessive draught is wasteful on account both of the heat which is lost up the chimney and of the greater heat required to keep an occupant of the room warm in the presence of a strong current of air. Every coal fire, it is concluded, should be fitted with an easily adjustable register, by which, when combustion is well established, the draught may be cut down so far as is consistent with satisfactory hygienic conditions. Dr. Fishenden points out that while the aggregate efficiency (by radiation and otherwise) of the coal fire in heating a room is generally at least 30 per cent. of calorific value, that of the best modern gas fires is known to be in the neighbourhood of 60 per cent., while that of electric fires in which there is no flue outlet may be taken as 100 per cent. With coal at £3 a ton, gas at 4s. 6d. a thousand cubic feet, and electric power at 1d. a unit, the cost of a coal fire for continuous heating is not quite one-half that of a gas fire and not quite one-quarter that of an electric fire of similar heating capacity. Gas and electric heating have, of course, great advantages in their superior cleanliness and convenience and in their special suitability for heating rooms which are used for short periods only; considerations of economy, however, will in most cases lead to the continued use of coal fires until they are forbidden by legislation or until the prices of gas and electricity are substantially reduced.

THE WORK OF THE ROCKEFELLER FOUNDATION.

A REVIEW by the president of the work of the Rockefeller Foundation during 1919 shows that what we take to be the main note of its policy has been maintained. This policy, as shown in the method of dealing with the prevention of yellow fever, ankylostomiasis, and malaria, is to use the funds and officers of the Foundation to start a campaign, and after it has been set going and its purpose is thoroughly understood by the local authority, to leave its continuance to that authority. In this way the work of the Foundation can be extended to one country after another without an undue call upon its resources, and the people and government of the country helped to rely on themselves for the future. Another part of the policy of the Foundation which appears very commendable is that it does not create inflexible fellowship systems, but embarks on temporary schemes of fellowships to meet special needs, as in the case of China. Fellowships and scholarships have been granted to the Chinese to enable them to study medicine in the United States, but when the college in Peking is fully under way the need for these fellowships will, it is held, largely disappear. In seeking to promote modern medical education in China the Foundation has recognized the need for preliminary education in physics, chemistry, and biology. With this object it has assisted certain existing institutions where instruction in these subjects is given; it has also arranged that instruction in these subjects shall be given at the Peking Union Medical College. Though the buildings of this college are not yet complete, it has begun work; 61 students were registered in the autumn of 1919; of these 32 entered the pre-medical school; 7 were in the first year of the undergraduate medical course, and 22 were graduate students and internes. The proportion of Chinese members of the teaching staff will be steadily increased as trained persons become available. Eventually the buildings of the school will include laboratories for anatomy, physiology and chemistry, a pathological building, a hospital with 250 beds, with provision for about thirty private rooms, an out-patient department, an administrative block with quarters for resident physicians and internes, a nurses' home, an animal house, and installations for supplying water, heat, electric light and power, and fuel gas. The staff that went to Guayaquil to mobilize the campaign against yellow fever included Dr. Noguchi, whose researches, resulting in the identification of the *Leptospira icteroides*, have been related from time to time in our columns. As the water supply of Guayaquil is intermittent, the water is stored either in tanks or in barrels, cans, or other containers which afford a suitable breeding ground for the stegomyia. The importance of screening these receptacles was pointed out, and, after several unsuccessful trials, a fish was found which survived in barrels and devoured larvae greedily. In dealing with malaria in Mississippi, minnows, which consumed the eggs of the anopheles, were found a cheap and effective measure, especially in the case of ponds used for watering cattle and horses, which could not be drained or covered with a film of oil. The tuberculosis work in France seems to have made good progress, and is being taken up by the local authorities. The appeal to popular sentiment is varied and adapted to all ages, one of the methods used being a hygienic punch-and-judy show, with a specially written piece.

PREVENTION OF EXPLOSIONS IN COAL MINES.

THE experiments initiated by the Committee of the Mining Association of Great Britain, and carried forward by the Explosions in Coal Mines Committee, showed that the addition of a certain proportion of inert dust renders coal dust (the inflammable agent in all great colliery explosions) non-inflammable. Statutory rules and orders[1] which have been issued under the Coal Mines Act, 1911, deal, amongst other matters, with precautions against coal dust and against the spontaneous combustion of coal, and with rescue work in coal mines. In all mines in which coal other than anthracite is worked—those mines being excepted in which the floor, roof, and sides of the roads are naturally wet throughout—it is laid down that the walls of the roads shall be treated (1) with incombustible dust, in such manner and at such intervals that the

[1] Statutory Rules and Orders, 1920, No. 1423. London: H.M. Stationery Office. 4d. net.

resultant dust mixture shall contain not more than 50 per cent. of combustible matter, or (2) with water, so as to ensure that the dust is combined with 30 per cent. of water in intimate mixture, or (3) in such other manner as the Secretary of State may approve. The management of the mines must cause the results of tests made not less than once a month to be posted at the pithead. No injurious dust is to be introduced; the use of gritty dusts or those containing a large proportion of free crystalline silica, both of which were reported by Dr. Haldane[1] to be injurious to health, appears to be precluded by the regulation which specifies that at least 50 per cent. of the added dust must be capable of passing through a sieve with 200 meshes to the lineal inch. Subject to a provision that the Divisional Inspector of Mines may allow an extension where the necessary provision of plant has been difficult, the foregoing regulations come into force on January 1st, 1921. In mines in which safety lamps are required, and in such other mines as the Secretary of State may direct, on the appearance of smoke or other sign indicating that a fire may have broken out below ground, workmen must be withdrawn from the districts affected; before their readmission the manager or under-manager, accompanied by the fireman, examiner, or deputy, and by two persons selected by the workmen, is required to examine the region affected or suspected, and to make a full and accurate report of the findings, which must be posted up at the pithead on the same day. If the existence of a fire has been ascertained workmen must not be readmitted, except under certain certified conditions; approved means must be taken to render harmless the coal dust in those of the contiguous parts of the mine which are accessible. For rescue work the breathing apparatus provided must be of an approved type; where there is a uniform oxygen delivery the reducing valve must be adjusted to supply not less than two litres of oxygen a minute. Before its use in a breathing apparatus, the oxygen must be proved to contain not more than 2 per cent. of impurities. Every breathing apparatus is to be tested at least once a month, and again before being used below ground. No person may be employed in a rescue corps or brigade unless he has passed the prescribed medical and physical test; every rescue corps, after being trained, must undergo at least six annual and one quarterly practice with breathing apparatus. A code of signals to be used in rescue operations is specified, and the rules for the conduct and guidance of persons employed in rescue work are set forth in a schedule which provides, *inter alia*, that a qualified medical man shall be in attendance at a mine whenever rescue parties are at work (unless in the opinion of the manager and inspector of mines and miners' representative that course is unnecessary); the doctor, when present, shall examine every man engaged in rescue work before permitting him to go underground for a second spell. At every mine to which the regulations apply a room must be provided and maintained exclusively for rescue and aid purposes; this room, distinguished by a large red cross on the door, must have a floor space of not less than 100 square feet, and must be supplied with adequate natural and artificial lighting, with satisfactory heating, and with a plentiful water supply; it is to be placed in charge of a person holding a certificate of proficiency in first aid from an approved society. The regulation that in any mine in which safety lamps are required to be used such a lamp is not to be unlocked or opened will not come into force until such date as may be determined by the Secretary of State after the receipt of the report of the Miners' Safety Lamps Committee.

[1] Cd. 8122. H.M. Stationery Office.

TYPHUS IN POLAND.

In our note last week commenting on Mr. Balfour's appeal, on behalf of the League of Nations, for funds to combat typhus fever in Poland and Galicia, we pointed out that, although the plan of operation is complete, the organization ready, and the methods to be employed are successful and well understood, the response to the appeal issued last May has met with scant success. This, we understand, has been due to the lack of adequate organization in pressing home the appeal and garnering its fruits. The body commissioned by the League of Nations with the conduct of the typhus campaign on the Russo-Polish frontier is the League of Red Cross Societies, whose head quarters are at Geneva, and the organization accredited by the League for the purpose of enlisting voluntary help within the British Empire is the Imperial War Relief Fund (Fishmongers' Hall, E.C.4), which is under the patronage of His Majesty the King and in close touch with the Overseas Governments. In Canada, Australia, and New Zealand the Governors-General have published their appeal on behalf of the Imperial War Relief Fund, and a vigorous campaign is in progress. In Australia, for instance, Sir Denison Miller, Governor of the Commonwealth Bank, is acting as treasurer of the Fund, and the appeal has been given prominence throughout the press. Effective measures have also been taken in the Crown Colonies and Dependencies. The Fund, which is in close touch with the British Red Cross, will hold a flag day in London on Saturday, October 2nd, under the auspices of the Lord Mayor, the Mayors of the Metropolitan Boroughs, and the Chairman of the London County Council. Ladies willing to help are requested to communicate with the Secretary at Fishmongers' Hall. In the meantime conditions conducive to the spread of the epidemic are reported from many areas in Central Europe. In certain districts in Prussia, for example, according to authentic information just to hand, these conditions are grave. In Breslau—to name one district only—of 22,544 adults who applied to an officially recognized relief agency, 10,300 had no body linen and 3,204 had but one chemise. Overcrowding by night and by day was rampant. Children in particular were suffering severely. Of 20,000 who applied, over 15,000 had no underclothing, more than 5,000 slept on rags, and 4,132 had no coverlet but their frocks. Eighty-six per cent. were undernourished, 41 per cent. were scrofulous, 48 per cent. tuberculous, and 72 per cent. suffered from bronchitis. Such conditions are, of course, highly favourable to the spread of the epidemic, and it is for funds to remedy them, as well as to provide medical assistance and supplies, that the Imperial War Relief Fund exists.

ISLAND LEPROSY.

An interesting report on the history of leprosy in Rodrigues, a solitary island in the Indian Ocean far to the east of Mauritius, has been made by the Government medical officer. The report reaches us through the Director of the Medical and Health Department of Mauritius, of which Rodrigues is a dependency. The report states that the information gathered from the oldest inhabitants and by personal investigation leaves no doubt that leprosy was introduced into Rodrigues by a man known as "Diango," who came from Mauritius about forty or fifty years ago. This man evidently married a native of Rodrigues; he was employed as a fisherman by a family residing at Oyster Bay, a small coast settlement. Four or five years afterwards he developed leprosy. Owing to his condition he left Oyster Bay, and went to reside up the mountain about four miles away. A year or so after his departure one of the sons of his employer, who used to fish with him in the same boat, became affected with the disease, which afterwards gradually made its appearance in other families, all residents of Oyster Bay. It is believed that there are at present twenty-three cases of leprosy on the island; sixteen of the patients are descendants "direct or through marriage" of the first family affected with the disease, and at one time or other were residents of Oyster Bay. The other seven patients scattered over the island are

descendants of "Diango." During the last seven years five deaths due to leprosy have been registered and nine new cases have come to light.

MONEY LENDERS AND MEDICAL AGENTS.

In a communication recently received, the head of a medical agency in London informs us that from inquiries he receives from time to time it would seem that some medical men are under the impression that he is in touch with a person who would advance money for the purpose of purchasing a practice or a partnership. Our correspondent expresses the opinion that it would be disgraceful for a medical agency to be in touch with a money lender or money lenders. That at least one money lender is anxious to get into relation with a medical agency is evident from further information we have received. We are confident that medical agents as a body would agree that an arrangement by which a medical agency received a commission for introducing a possible purchaser of a practice to a money lender is improper, and must in the long run have a very injurious effect upon the business of medical agencies. A young man who tries to make a start in life with the aid of a money lender must, as a rule, prepare himself for an unhappy career.

With deep regret we announce the death of Lieut.-General Sir William Babtie, V.C., K.C.B., K.C.M.G., which took place very suddenly on September 11th whilst he was spending a holiday on the Belgian coast. A memoir will appear in an early issue.

The Council of Epsom College will shortly award several France pensionerships of £30 a year to aged medical men in reduced circumstances; also a Home Scholarship of £30 a year to the necessitous orphan daughter of a medical man who was for not less than five years in independent practice in England or Wales. Particulars can be obtained from the Secretary of the College, 49, Bedford Square, W.C.1.

COLONIAL MEDICAL SERVICES.

Report of the Departmental Committee.

On February 23rd evidence was given by the British Medical Association before the Colonial Medical Services Committee, appointed last autumn by the Secretary of State for the Colonies. The memorandum of evidence appeared as an appendix to the Report of Council, printed in the Supplement of April 24th, 1920. In a Current Note in the Supplement of August 14th we urged that the Departmental Committee's report should be presented to Parliament and published without delay. The report has now appeared as a White Paper,[1] and to it is appended a letter from the Colonial Office to the Chairman of the Committee, Sir Walter Egerton. The other members were Sir Harry Verney, Sir Humphry Rolleston, Sir William Leishman, Sir James Kingston Fowler, Dr. T. Hood, and Mr. A. Fiddian.

The terms of reference of the Committee were:

1. To consider generally the position of the Medical Service of the various Colonies and Dependencies for which the personnel is now provided by the Secretary of State, with a view to maintaining and increasing the supply of candidates for appointment as medical officer and to securing contentment within the Service.
2. To consider whether the principle of assimilating the medical service in neighbouring Colonies, as already adopted in West Africa, may usefully be extended, and, if so, how far and by what means.

The Committee decided to hear evidence from witnesses competent to express the views of the medical staffs of the various groups of Colonies to which appointments are made by the Secretary of State, and also from others acquainted with the conditions of the Colonial Medical Services. The British Medical Association was informed that the Committee would be glad to receive its views, either in writing or through witnesses, and the Committee expresses its thanks to the Association for the assistance afforded by the memorandum received in reply to this communication, and also for the evidence given in support thereof by the witnesses nominated by the Council. The Committee held twenty meetings for the examination of witnesses and the consideration of its report.

[1] Cmd. 939. H.M. Stationery Office. 2d. net.

A Unified Colonial Medical Service.

The ideal is declared to be a unified service, its personnel recruited from men recently qualified to practise, and liable for service in any of the various Colonies to which appointments are made by the Secretary of State. The Committee realizes, however, that the full attainment of this ideal is not possible at present; in the recommendations made in the report this fact has been kept constantly in view, and the Committee confines itself to "such measures as are practicable, and would yet go far to meet the legitimate desires and grievances of the various Services."

The report sets out briefly under eight heads the difficulties which appear to stand in the way of recommending the creation under present conditions of a unified service, such as the R.A.M.C., under a Director who, subject to the approval of the Secretary of State, would have the power of appointment to and transfer from each and every colony, the officers of the Service being freely interchangeable between the various administrations. But, should its recommendations be carried into effect, the Committee advises that after, say, five years the experience gained should be reviewed by another committee, in order that, if justified, further steps may be taken towards forming a still more unified service.

Hitherto a candidate has applied for a medical appointment in a special colony, or group of colonies. The Committee recommends that in future the application should be made for admission to "The Colonial Medical Service." The following advantages are foreseen as likely to attend the creation of a unified service:

It would be recognized as a distinct branch of the public medical service of the Empire and its status would be enhanced; this would tend to encourage recruiting—an urgent matter at the present time. Moreover, the questions at issue affecting the interests of a unit of the Colonial Medical Service—for instance, the West African Medical Staff—would probably be settled with much less display of feeling if those concerned knew that they had been submitted to a man of standing in their own profession, even should the decision of the Secretary of State go against them. Possibly the most important and obvious advantage would be that throughout the service, and particularly by the West African Medical Staff, it would be regarded as an attempt to provide them "with an adequate channel through which to express any feelings of discontent that may arise at any time."

The Director-General.

The Committee advises that an officer of standing in the medical profession, whose opinion would have weight with the Secretary of State, and whose name would create confidence in the profession, should be appointed a member of the Colonial Office staff, with a title commensurate with the importance of his position; the majority of the Committee recommends that the title should be "Director-General of the Colonial Medical Service." His duties are set out as follows:

(*a*) Generally he should advise the Secretary of State and the permanent staff of the Colonial Office on all questions relating to the personnel of the Colonial Medical Service as distinct from questions of medical and sanitary theory and practice.
(*b*) He should be accessible to all officers of the Colonial Medical Service who might wish to see him when they are at home on leave.
(*c*) He should advise on all changes in the regulations and conditions of employment of medical officers.
(*d*) He should assist in the interviewing of candidates and of possible candidates for appointment in the Colonial Medical Service.
(*e*) He should be a member of the subcommittee on colonial medical appointments if the present method of entering the service is continued. If it is not, he should be a member of whatever committee may be appointed to interview candidates for medical appointments before their admission to any examination it may be decided to hold.
(*f*) He should keep in touch with the medical schools in the United Kingdom.
(*g*) He should be a member of the Advisory Medical and Sanitary Committee for Tropical Africa when questions of promotion are under consideration by that Committee, and also of the Promotions Committee of the Colonial Office in connexion with the fitness of officers for transfer and promotion in other units of the Colonial Medical Service. For this purpose he would have access to the confidential reports on officers of the Colonial Medical Service.
(*h*) He should endeavour to keep in touch with the feeling of the service and to bring the existence of causes of discontent to the notice of the Colonial Office.
(*i*) He should be concerned in the preparation of and annual revision of a Colonial Medical Service List, to which reference is made below.
(*j*) Should it be decided to adopt the examination system as the method of entry into the Colonial Medical Service, all proposals relating to such examination and its details and conditions generally should be arranged in consultation with him.

In defining the Director's administrative functions, the Committee disclaims any intention of suggesting that he should be debarred from taking interest in or expressing opinions on medical and sanitary questions. Copies of dispatches, memorandums, reports, and so on, sent to or from the various colonies and protectorates on medical and sanitary matters would be passed

to him for his information, and he would be free to bring to the notice of the Department points which he judged important. The Committee, having outlined the duties of this officer, holds it equally important to state in explicit terms the functions that should lie outside his sphere of action:

> The regulation of the discipline of individual members of the service whilst serving under Colonial Governments would remain with the Governor and principal medical officer of the colony concerned. He would have no control over officers whilst actually serving in any colony; such matters as appointments to stations, leave, discipline (except when the action of the Secretary of State might be necessary), etc., would remain under the control, as at present, of the Governor and principal medical officer of the colony. His correspondence would, of course, be subject to the general rules of the Colonial Office. He would not be expected to visit the colonies

Personnel of the Service.

The Committee thinks it most desirable that candidates should be attracted from among the best type of young men fresh from medical schools. The importance is urged, both in the interests of the individual and of the Service, of seconding recently qualified men for a resident appointment, preferably at the hospital where they were trained in the practical subjects of their profession:

> "It is scarcely possible to overstate the importance to a young medical man of holding such an appointment at the most receptive age under teachers of acknowledged position. Officers who have been seconded at the termination of their appointment, and all others not so seconded, should attend a course at a school of tropical medicine before proceeding abroad. Seniority and pension rights should be carefully safeguarded in order that officers so seconded may not be placed at any disadvantage."

The Committee recommends that admission to the Service should in future be by competitive or qualifying examination, in place of the present method of classification, while on several minor points the Service might be made more attractive:

> The chief and only really important cause of the difficulty in adequately filling vacancies, apart from the scarcity of medical men during the war, is that the improvements in salary and pension prospects in the different colonies have not kept pace with increased rates of emoluments in other classes of medical employment and in private practice, or with the increased cost of living.

The Committee thinks it might be an advantage were a single entrance examination held for all the public medical services, and if so, the Colonial Medical Service should fall into line with the other departments concerned —that is, the Navy, the Army, India, and the Royal Air Force. It is added, however, that candidates ought to be approved at a preliminary interview by the department prior to sitting for this examination. Assuming that the principle of admission to the Service by examination is accepted, the Committee holds it necessary for the Secretary of State to reserve the right of appointment by selection to certain posts, and this would apply also to admission to certain new departments of the Service.

Organization of the Service.

Since a completely unified service is not at present thought possible, candidates would have to offer themselves for service in those colonies for which they are eligible according to the regulations in force. The Colonial Office is at present organized in geographical departments, each dealing with the affairs of one or more colonies or groups of colonies. It is recommended that the Colonial Medical Service should be organized in the same manner, and that candidates should apply for admission to the Service in one or more of those departments.

The Committee next considers the possibility of forming into separate units the medical services of neighbouring colonies. Having regard to the conditions prevailing in the different groups of tropical colonies, the conclusion is reached that, beyond the existing West African Medical Staff, the following are the only other medical services that can with advantage be assimilated:

> (i) The medical services of the Straits Settlements and the Federated and Unfederated Malay States.
> (ii) The medical services of the East African Protectorates (Somaliland, Uganda, Nyasaland, Zanzibar, and the East Africa Protectorate) and the Tanganyika Territory.

The Committee recommends that in future one Malayan Medical Service should be recognized on first appointment, and that there should be one roster for promotion, officers being transferred and posted to and from the various administrations in this group. In view of the conspicuous success attending the assimilation of the medical staffs of the four West African Colonies, the Committee strongly recommends that a like staff be formed for the East African administrations, with conditions of service, pay, pension, and gratuity parallel to those in the West African Medical Staff, so as to facilitate the ultimate combination of the two services into one medical staff for British Tropical Africa.

The Committee regards as a matter of urgency the appointment of senior officers for West and East Africa to make frequent and regular inspections of the individual stations and of the Colonial Medical Service generally; these might be styled "Inspectors of Medical Services," provided that "medical" is understood to include the duties now classed as "sanitary."

Pay, Leave, Promotion, etc.

The need for increased pay is fully recognized by the Committee; it declares that the Colonial Office, if it is to attract young men of the right type, should offer an initial salary of at least £600 per annum for whole-time appointments, and that substantial additions must be made to the salaries now offered in the various units.

Understanding that the question of the age of voluntary retirement and rates of pension is under consideration, the Committee refrains from making specific recommendations, but hopes the claims of medical officers will be considered in a generous spirit. It recommends that the gratuity now given to officers in the W.A.M.S. who desire to retire after nine years' service should be continued and increased to £1,500; that the gratuity after twelve years should be increased to £1,875; that similar gratuities should be instituted in the E.A.M.S., or even made general throughout the Colonial Medical Service. Here the Committee stigmatizes as narrow and false the view that the medical service of a colony is not a "productive" service—that is, that the value of its work cannot be stated in terms of £ s. d. This view, it says, should be combated whenever put forward as a reason for postponing or refusing funds.

In the matter of leave it is argued that the Colony in which the officer has been serving should be responsible for his pay whilst on leave, and that the period of leave earned should be on full pay. The grant to an officer returning home on leave of the free passage both ways for himself and his wife, and children to the number of two, is considered equitable and deserving of adoption. Hope is expressed that provision for the widows and orphans of officers may be developed. Recommendations are made to facilitate study leave on full pay, the fees being paid by the Government. As to specialist appointments, the Committee is strongly impressed with the desirability of introducing into the Colonial Medical Service the principle that an officer may attain to the highest rank and pay whilst continuing to practise the branch of the profession to which he has devoted his life. It accordingly recommends that specialist appointments should be created and given to officers of the Service who have shown capacity in some recognized branch of medical science or practice and who desire to continue their particular work. Regarding promotion, the Committee is not disposed to adopt the view that the increase of pay by annual increment is an evil tending to remove any incentive to effort. A uniform nomenclature for administrative officers is recommended; thus the head of the medical department in each colony should be called "the Director of Medical Services" (D.M.S.), and so on. Interchange of medical officers between colonies should be facilitated, but when a move or transfer is effected an officer should not suffer loss, but be allowed all reasonable expenses entailed by the change; nor should transfers be allowed to injure the ultimate pensions of the officers transferred.

Further recommendations deal with defective quarters, confidential reports, posting to stations, the desirability of setting up medical reference libraries in each colony, auxiliary medical services, the encouragement of research work and the establishment of medical research institutes, and the question of precedence and honours. Lastly, it is advised that a Colonial Medical Service List should be kept, giving full information as to conditions of service under the Colonial Governments, and the names, qualifications, and services of the officers in each unit of the Service, and of locally appointed officers. In conclusion, the Committee expresses the belief that:

> "By the adoption of the above measures the causes of discontent which have existed in the Service in the past will be removed, and that the Colonial Medical Service will attain to a very high, possibly even to the highest, status amongst the public medical services of the Empire."

In the letter of the Colonial Office to the Chairman, dated August 28th, it is stated that Lord Milner will not be able to deal fully with the Committee's recommendations until he has consulted the administrations of the various colonies and protectorates. "There is, however, no question connected with Colonial Administrations to which he attaches more importance, and he is glad to state that considerable progress has been made in the direction desired by the Committee." Three instances are given: (1) Unification of the East African Medical Service is said already to have been accomplished in everything but name; (2) the pay of the West African Medical Staff has been completely revised, with an initial salary in excess of £600 a year; (3) considerable progress is being made in the improvement of facilities for research in the Colonies.

THE DISCUSSION AT CAMBRIDGE ON THE FUTURE OF MEDICAL PRACTICE.

BY

PETER MACDONALD, M.A., M.D.

No more interesting or more valuable discussion has ever taken place under the auspices of any medical body than that held at the meeting of the Section of Medical Sociology at the annual meeting of the British Medical Association at Cambridge on July 2nd. It ought to receive the closest attention of every medical practitioner, as it hinted at changes which may prove revolutionary, and will affect every member of the profession, whether general practitioner, consultant, laboratory worker, or State or municipal servant.

The opener, Sir George Newman, was not very definite as regards proposals, except for his quite definite statement that he would do nothing to discourage that individualism which most medical men will agree is of peculiar value to medicine; but it was evident that both he and those who followed him were pleading for an assumption by the State of more or less responsibility for the health of the nation. With this I am in entire sympathy. The fact that I myself, in a report which I drafted for the York Panel Committee, was, I think, the first, or one of the first, to adumbrate in print most of the proposals which seem to have found favour with the openers of the discussion and also of the Advisory Committee to the Health Ministry, will show that I am enthusiastic as to this assumption by the State of full responsibility for the medical services needed by the community, so long as the individualism of the profession, which I regard as of first importance to the profession and the community, is reasonably safeguarded. It is a cause for legitimate pride that it is from our own profession that the impulse has come which may help towards a solution of a difficult problem.

My object, however, in writing now is to utter a word of warning. Desirable as it is that the State should take full responsibility for the health of its citizens, it should do so only on conditions which will allow of its doing the thing efficiently; and it were better that the Medicine of this country should not be interfered with further at all by the State unless this interference is to lead to a better state of things. We, too, as a profession must not advocate change, but reform; for change without reform may lead—indeed, is likely to lead—to disaster.

To my mind it is clear that there are three essentials to the establishment by the State of a satisfactory medical service:

1. That this service should be complete. All sections of the necessary medical services need not be established complete at once, but any section dealt with by the State should be dealt with completely. It might, for instance, be possible to set up an adequate hospital service by itself to begin with; and this is at present the most urgent of medical problems. But sooner or later the co-ordination of all forms of service under the aegis of the State would certainly be found necessary.

2. That the medical profession should have the largest possible share in the management and control of the service, and that bureaucratic interference with the profession should be the least possible.

3 That provision for the services should be adequate. On this last point it is of urgent importance that the profession should have clear and decided views, and it was hardly raised at the discussion at Cambridge.

The Cost of a Satisfactory Service.

Unless ample financial provision is to be made to allow the medical service supplied to be of the very best, then any further incursion by the State into the province of medicine is undesirable, and, so far from being advocated by the medical profession, should be strenuously resisted.

I have endeavoured to work out the costs of a complete and fairly satisfactory medical service for my own city of York, and from this a sum of proportion will give an estimate of the cost of a complete service to the State as a whole.

For the moment I do not wish to raise the question as to whether the establishment of a complete service is desirable, or on what lines it is to be set up—whether partly by extension of the panel service or otherwise; but the profession must remember that the National Health Insurance Acts meant a very large assumption by the State of responsibility for part of the country' smedical services; that force of circumstances will compel the State to undertake to a greater or lesser extent the burden of hospitals; and that there is at least a possibility of the State being compelled to undertake responsibility for all the medical services of all but the comparatively well-to-do.

I take as a basis to form my estimate the cost of present medical services, so far as they are given and can be ascertained.

(a) General Practitioners' Service.

The cost of private practice and of club practice cannot be ascertained, but the cost of the present panel service for this year for the city of York will be about £19,100. To make this a complete service means to extend it to dependants—that is, to the bulk of the rest of the community. York seems to be peculiar in that the insured population bears a higher ratio to the total population than that of the kingdom generally. The total population, taking the figures of the medical officer of health, is 77,639, and the figures of the Ministry of Health for the insured population is 35,000. This latter figure will probably be found to be too high, as it includes "inflation of lists." This inflation will certainly be less than in former years, but no great error will be made by assuming the correct number to be 30,000. To extend the medical benefit of the Insurance Acts to the rest of the community of similar economic circumstances would mean to increase the cost in the proportion of about 72,000 to 30,000; or, in other words, the cost would become approximately £46,000. This is on the basis of the present capitation fee, and there is a strong case for thinking that a satisfactory service for women and children should bear a higher fee; and no satisfactory service, whether on the plan of a panel service or otherwise, can be given at a less cost. I of course admit that service of a kind might be given at a less cost, but only, in that case, one that would degrade medicine and degrade the medical profession.

(b) Hospital Service.

I would like to "cross the t's and dot the i's" of what Mr. Morris of the London Hospital said at the discussion—that "the day of staffing voluntary hospitals by honorary officers is past"; but I think that this needs restating more strongly, and I should have been glad if he had said that the day of voluntary hospitals is past, or, at least, passing, whether we like it or no. Incidentally, I would like to resist strenuously the method favoured by Mr. Morris of easing the finances of voluntary hospitals by charging each patient a part of his cost to the hospital. At the London Hospital they charge, or propose to charge, the patient one guinea a week, the cost to the hospital being about four guineas. This I regard as a most dangerous precedent. It may be necessary to continue hospital services as a charity, or it may be better to make them a right of every citizen; but to supply them as a charity and to delude the recipients of the charity into the belief that they are not receiving charity, as making them pay part of their cost would certainly do, will, I am certain, be bad policy for all concerned. The expenditure of the York Hospital for 1919 was about £20,000; but this relates not to York but to a larger area, and I estimate the cost as applying to the city of York as two-thirds of this, equal to £13,333 13s. 4d.

Now, I am satisfied that the needs of the community demand an increase of the number of hospital beds, and that this should be multiplied by three. Mr. Jenkins, who spoke for the Labour party by invitation at the Cambridge Conference, said six, but probably three would be enough, and I feel confident that I could make out a good case for at least three. These need not be under the same roof, and many of them should be convalescent beds; and though this might reduce the cost per bed on the one hand, yet on the other, the fact of having separate establishments would tend to increase the costs, so that the cost per bed would have to be multiplied by three, making £40,000. Some of these, however, might be "paying" beds, which might reduce the cost to (say) £32,000.

These figures for hospitals, however, are based on gratuitous medical services, which could not continue under State or local authority provision; and I take as the cost of medical service, for purposes of argument only, the very low figure of £8,000. I think it likely that this figure is too low, but at present my object is only to give minimum figures. The hospital costs would accordingly be raised from £13,333 to £40,000, and the figure will be higher if nurses are to be reasonably paid.

(c) Present State Service.

Examples: Departments of M.O.H., tuberculosis, school, Poor Law, post office, pensions, some military work, venereal department, fever hospitals, city asylum, etc. The cost of that part of these services supplied by the Corporation of the City of York in 1919 was £36,579. The cost of the remainder I was not able to ascertain, but it is small and for the purposes of this article negligible. Some of these services would be merged, and therefore included, in the costs of the above general practitioner and hospital services, so that the cost of these would be in that respect lowered. On the other hand, the city medical services are underpaid; so that the reduction in costs would not be great. And it must be remembered that it is the tendency of the time to increase public health services. Let us assume that the cost would be lowered to £34,000.

(d) Present Poor Law Infirmary.

This has 370 beds. No separate accounts are kept for the workhouse and the workhouse infirmary, so the cost of the

infirmary must be an estimate. I have worked it out at about £13,000, and the cost of this, referable to the city of York, is five-sixths—namely, about £11,200, for the year 1919. This city infirmary is, unlike many workhouse infirmaries of the country, far from empty; and it is usually more than two-thirds occupied. Some of these beds may become unnecessary in view of the increase above indicated of hospital beds; but the decrease will not be great; 124 of these beds are for imbeciles, and about 50 for senile infirm people; and many of the remainder are used for chronic invalids and incurables not suitable to be hospital cases. But if we assume that the number of beds might be somewhat lessened, and take the estimated remaining cost as £10,000, we shall not be far wrong.

(e) Additional Services.

The above make practically no provision for a very big, indeed, a gigantic, problem—that of dental service; and it is certain that there will be other increases in specialists' services, such as pathological, laryngological, dermatological, etc., certainly associated with the hospitals but not provided for in my figures above. Any figure to supply these must be a guess, but it will not be less than £5,000, probably nearer £10,000 to supply them efficiently; let us take the figure of £7,500.

Summary.

These figures are summarized in the following table:

A Rough Estimate of the Cost of a Complete Medical Service for the City of York.

	Cost of Present Service.	Cost of Present Services to State or Local Authority.	Cost to State or L. A. of Complete Service.	Increased Cost to Community of Complete Service.	Increase or Decrease of Cost to State or L. A. of Complete Service.
	£	£	£		£
General practitioner service (present panel) ...	19,100	19,100	46,000	Probably none.	26,900
Hospital service (other than fever hospitals, etc.)	13,333	*Nil*	40,000	?	40,000
Present State service (M.O.H., Poor Law, etc.) ...	24,217	24,217	21,638	Probable decrease, £2,579	Decrease, £2,579
Pauper lunatics in City Asylum	12,362	12,362	12,362	None	None
	36,579	36,579	34,000		
Poor Law Infirmary	11,200	11,200	10,000	Decrease, £1,200	Decrease, £1,200
New special services	*Nil*	*Nil*	7,500	?	7,500
Total	£80,212	£66,879	£137,500		£70,621
Cost per head of population	Over 20s.	17s. (approx.)	Over 35s.		About 19s.

NOTE.—The increase of cost to the State or Local Authority of the Hospital Service is the total cost. None, or practically none, of this is now borne by the State.

From this table it is seen that the cost per head of population of present services is about 20s.; that the State or local authority pay about 17s. of this; that the cost of a complete State service (the word is here used without implying whole-time or salaried service) would be about 35s., and the increased cost borne by the State about 19s. per head of the population.

Now, the city of York is fairly representative of the country. It is urban, yet semi-rural; it is partly a manufacturing, partly a residential city; figures based on its figures, or an estimate of figures for it, will give a fair indication of figures applicable to the whole country.

The figures given above mean that a complete medical service would cost the State between 70 and 80 million pounds annually, meaning an increase of cost to the State of not less than 40 millions on what it is at present spending, and this without taking into consideration anything to represent interest and sinking fund on capital costs. And it must also be remembered that the estimate I have given is a low one, probably too low to allow of that efficiency which is the first essential of our requirements; that it is based mostly on figures for 1919, and that costs have gone up since then and the value of money has gone down; that the demands of labour are likely to increase costs further. However this may be, my argument depends, not on the complete accuracy of my figures, but upon the fact, which I claim I have demonstrated, that the increase of the cost to the State of a satisfactory medical service will be a large one.

Now comes the question: How are we going to get this kind of thing for the medical needs of the community, postulating for the moment that it is desirable? Shall we get it from the politician? Shall we get it from the sort of persons now running the Ministry of Health? I had a little experience of the Ministry of Health in the endeavour to get for the panel service terms which would allow of its being made an efficient service. This experience did not make me feel inclined to swell with pride from the knowledge that the medical needs of my country were in the hands of people with a real grasp of what these needs were. I did not feel that the Ministry of Health was free from the influence of opportunism; it was not very clear that a change of name from Local Government Board to Ministry of Health indicated any change of heart. (I would like to interpolate that nothing of this applies to the late Sir Robert Morant.)

Any satisfactory solution of the medical problem is impossible so long as the management of the country is on its present lines; and if this is so, are we, as medical sociologists, to plead for what we know under present conditions to be impossible? Or are we rather to strive for a better state of affairs; to remember that medical sociology is part of a general sociology; to help to rescue the country from the politician, and to replace the politician by the sociologist, or convert the politician into a sociologist; particularly to remember that the future of this country and of the world is not with the politician, but with the scientist; and that if the scientist were set free to solve the problem of production, all the millions and hundreds of millions needed for the medical problem, the housing problem, the National Debt, would be a mere flea-bite in comparison with the possibilities of wealth the scientist might make for us. One of the valuable contributions to sociology of the great American sociologist, Lester Ward, was the thought that the path to progress is indirect. To my mind this problem in medical sociology does not and cannot stand by itself; it is part of the whole problem of the country's future, and I believe that the most fruitful thing we, as medical sociologists, can do at present is (first) to help to promote a public opinion which will bring peace to the world, and (second) to influence the politician, so long as it is he who controls the country, to give that endowment to science which is the only thing which will allow of that increase of production, and which will in turn allow all these medical needs, as well as other desirable things, to be added unto us.

ROYAL MEDICAL BENEVOLENT FUND.

AT the meeting of the Committee held on August 10th, twenty-two cases were considered and £244 11s. voted to twenty of the applicants. The following is a summary of some of the cases relieved:

L.S.A.Lond., aged 63, married, who for some years has acted as locumtenent. Has recently completely broken down in health, and is in hospital suffering from tabes dorsalis. Last year only earned £121. Rent £32 10s., and wife lets an unfurnished room at £11 4s. Friends have given £10. No prospect of applicant being able to work again, and they are practically destitute. Voted £26 in twelve instalments.

Daughter, aged 62, of M.R.C.S.Eng. who died in 1903. Owing to nervous breakdown applicant has been for some time in a nursing home. Is now staying with friends, who will be unable to keep her. Income £50 from investments. Desirous of getting into a home. Voted £12 in twelve instalments.

Wife, aged 46, of F.R.C.S.Irel. Owing to overwork and financial worry applicant's husband is completely incapacitated, and it is not expected that he will be able to work again. Three children, aged 23, 20, and 10. The eldest, a daughter, earns £3 a week. The son, aged 20, is going to Australia. Rent £115 for an eleven-roomed house, the lease of which runs out in September, when £300 will be required for dilapidations. A friend has lent the money to pay the rent up to September. Desirous of getting a house and letting rooms, and asks for help to make a start and towards the youngest son's education. Voted £10.

Daughter, aged 56, of M.R.C.S.Eng. who died in 1894. Suffers from ill health, and is unable to earn anything. Shares everything with her two sisters, one of whom has help from the Fund. Relieved ten times. £132. Voted £12 in twelve instalments.

Daughter, aged 61, of M.R.C.S.Eng. who died in 1861. Until recently has acted as school matron at £30 a year, but is at present out of employment, and owing to her age finds it difficult to obtain another post. Is at present staying with friends. Has no income but that which she earns. Relieved once, £10. Voted £5.

Subscriptions may be sent to the Honorary Treasurer, Sir Charters J. Symonds, K.B.E., F.R.C.S., at 11, Chandos Street, Cavendish Square, London, W.1.

The Royal Medical Benevolent Fund Guild is overwhelmed, in these days of exorbitant prices for clothing and household necessaries, with applications for coats and skirts for ladies and girls holding secretarial posts, and suits for working boys. The Guild appeals for second-hand clothes and household articles for the benefit of the widows and children who in happier times would not have needed assistance. The gifts should be sent to the Secretary of the Guild, 43, Bolsover Street, W.1.

Scotland.

EDINBURGH ROYAL INFIRMARY.

AT the meeting of the board of managers of the Edinburgh Royal Infirmary held on September 7th it was reported that the contributions for the past five weeks amounted to £6,361. In addition to this a sum of £15,000 was received from the British Red Cross Society, Scottish Branch, City of Edinburgh Committee, to be applied in or towards the provision of a new electrical department, including radiography, to be permanently associated with the name of the society.

The retirement is announced of Dr. W. G. Sym, F.R.C.S.Edin., ophthalmic surgeon, Edinburgh Royal Infirmary. Dr. Sym acted as assistant ophthalmic surgeon from 1890 to 1905, and for the past fifteen years as ophthalmic surgeon in charge of Wards 41 and 42 and the associated out-patient department. In consequence of Dr. Sym's retirement Dr. A. H. H. Sinclair has been promoted ophthalmic surgeon with charge of the wards.

SMALL-POX IN GLASGOW.

On September 4th and 5th three cases of small-pox were admitted to hospital in Glasgow; on the 6th four, on the 7th three, on the 8th three, on the 9th four, and on the 10th three. The total number under treatment, which at the beginning of the week was 89, had risen to 97 at the end. There were three deaths.

EDINBURGH UNIVERSITY LORD RECTORSHIP.

The Edinburgh newspapers announce that Mr. Lloyd George has consented to stand as Coalition candidate for the office of Lord Rector of Edinburgh University. The election takes place in October, and the Prime Minister's willingness to stand is expressed in a letter addressed to Mr. W. S. Morrison, president of the Edinburgh University Unionist Association.

Correspondence.

PUERPERAL SEPSIS.

SIR,—In the discussion at the Cambridge meeting of the Association it was generally agreed that our knowledge of the factors which determine the incidence of puerperal infections is very imperfect. It was recognized that cases of autoinfection can and do occur, and importance was attached to the facts: (1) that the ano-perineal region of a woman is always a heavily infected area, difficult or impossible to sterilize, and (2) that in fatal cases of septicaemia the only organisms recovered from the blood or other tissues may be those normal to the intestinal tract.

If these facts have any significance, it must be that the more thorough the attempts at sterilization and the fewer the manipulations during labour, the more likely is the patient to escape infection. Clinical experience from the time of Semmelweis to the present day has taught the same lesson; and whilst it is undoubtedly true that cases of autoinfection are seen occasionally, this fact does not lessen the responsibility of the practitioner to use every device known to antiseptic and aseptic surgery to protect his patient. The more rigidly he observes this ritual the fewer will be his cases of infection.

The statement of a correspondent in the JOURNAL of September 11th, p. 412, that "In these days puerperal sepsis is in every case an autoinfection, and its incidence has no relation whatever to manipulations during labour," is disproved day by day in the receiving room of every general hospital in London.—I am, etc.,

London, W., Sept. 11th. HERBERT WILLIAMSON.

THE WAR PHYSICAL CENSUS.

SIR,—I do not know whether Sir James Galloway's thought-provoking address, printed in the JOURNAL of September 11th, was followed by any adequate discussion when it was delivered at Aylesbury, but I am sure that many would be glad if you could afford the space, and Sir James Galloway the time, to elucidate further some of the questions to which it gives rise. Their national, as well as their professional, importance affords sufficient excuse for me to put some of them for your consideration.

Sir James Galloway admits that "there are certain errors underlying these great masses of figures"; but believes that it may be safely concluded that the fact, for instance, that "a large number of the fit young men had volunteered or been called up for service before the last year of the war" (to which year alone his figures apply), is counterbalanced by "the fact that in many places the examinations were carried out for the first time on fit men who had been retained during the earlier years of the war on reserved occupations, and the young men presenting themselves for service on reaching the age of 18 in the year under review." Surely this is a very inadequate counterbalancing. These examinations tabulated included those of all the older men up to 50, and in some cases 55, years of age, and those resulting from a second "comb-out" of reserved occupations. Clearly the bulk of the best men physically had been included in previous examinations, and is it not a fact that a considerable proportion of the youths of 18 years were immature? Can it be doubted that for war purposes the standard of men between, say, 22 and 30 years was better than that of the youths between 18 and 22? In the only instance given by Sir James Galloway, "of 200 youths of 18 to 20 years of age examined and rejected in the north-western region of England, no fewer than 85 were rejected on account of poor physique." Differing from Sir James Galloway in his belief, I can scarcely doubt, on the evidence given, that, as regards statistics, a review of the whole male population between 18 and 50 years of age would, in normal conditions, give a better result than the figures he gives for the last year of the war.

Again, in any case the figures refer, of course, only to adult males. Sir James Galloway naturally says this in giving the statistics, but in suggesting the lessons of the figures he slips very easily into speaking of the physical condition of "our people," of "our adult population," of "the nation." Are we justified in thus ignoring the women? Is it not likely that an examination of all adult females, from youth to middle age, with a view to discovering their physical fitness for performing their normal social functions, would give better results? And is not the importance of the woman on the rising generation and the national physique even greater than that of the man?

This brings me to a further consideration of the utmost importance. It is seen quite clearly in the case of women, but it is equally germane in the case of men. Here was an examination to discover the degree of physical fitness for—what? For employment in the forces during war. But men were not born to be cannon-fodder, nor even to be hard-working auxiliaries thereto. The standard of efficiency for the best purposes, or for the ordinary purposes, of life is not that of physical fitness for active employment in war. Such meagre information as we have seems to suggest that Shakespeare was a physically healthy man—but who knows? And might it not have been better for the nation and for humanity if, say, Rupert Brooke had been found physically unsuitable for military service? Even the agricultural labourers, to whom Sir James Galloway specifically draws attention, seem as a class to be reasonably effective, beyond the average span of years, for the purposes of agricultural labour. We

should be quite wrong, as it seems to me, to draw sweeping conclusions as to our national fitness and efficiency from the figures which Sir James Galloway uses as the text of his address.

Even if, after discussion, the questions which I have here raised are answered in the way that I think they must be, I should be the last to belittle the importance of an increased attention being paid by the community and the profession to our national physique. I have for years been preaching (and, as an administrator, acting accordingly) that mother-craft and house-craft are not, as a rule, inborn accomplishments, but require to be taught effectively in all our schools and afterwards; that knowledge of a body of facts concerning personal health and an experience of the general practice of hygiene are as necessary for our children and adolescents as a mere course of school games and drill; that manual work, even under healthy conditions, is no substitute for proper physical culture, which is usually necessary to counteract the irregular development and muscle-saving devices which such work, if effective, generally entails. Though Sir James Galloway's statistics do not, as I think, necessitate a pessimistic outlook as to our national fitness, I hope his address will arouse or renew our professional zeal in the directions I have indicated as well as in those matters which more obviously enter into our daily routine in the treatment of disease.—I am, etc.,

London, N., Sept. 11th. H. B. BRACKENBURY.

THE TREATMENT OF FRACTURES.

SIR,—In connexion with the correspondence on the above subject it is pertinent to emphasize again what appears to be the real claim in the letter of Sir John Lynn-Thomas—namely, that before the war and during the war the treatment of fractures in general, in the hands of the Liverpool School of Orthopaedic Surgery and its disciples, was always adequate. In dealing with lower limb fractures this implied simply the correct use of the Thomas splint. The so-called modern methods of the war, when efficient, were founded on technical modifications of fully worked out principles derived from the ripe experience of the exponents of the Liverpool school.

The difficulties encountered in the treatment of the war fractures were those dependent on the presence of infected tissues, both soft parts and bone. Such conditions are, happily, not often reproduced in civil life.

The period of fixation necessary in simple fractures is short, and the chances of subsequent interference with joint mobility exceedingly slight.

For widespread use simple apparatus is desirable; in lower limb fractures, excepting those in the immediate neighbourhood of the hip and ankle joints, the Thomas splint in its pristine simplicity cannot be surpassed. Students, both undergraduate and post-graduate, should be taught the correct use of this splint, and the fracture equipment of the country hospital should include the Thomas above all others.—I am, etc.,

Manchester, Aug. 25th. HARRY PLATT.

ANTIMONY IN KALA-AZAR.

SIR,—Dr. Christopherson's letter in your issue of August 14th, page 256, undoubtedly appeals to all practitioners who are working to stamp out those dread diseases bilharzia and kala-azar. Having treated kala-azar cases by intravenous injections of antimony for the past three and a half years, the following remarks may prove of interest.

At first I employed the potassium salt of antimony tartrate and used a 2 per cent. solution in normal saline. The initial dose was usually 2 c.cm. given every second day and cautiously increased by ½ c.cm. until the patient was receiving 7 c.cm., this being regarded as a maximum dose, and practically represented 2½ grains of tartar emetic. Although there were fortunately no regrettable accidents, I speedily came to the conclusion that this solution was far too toxic, as evidenced by coughing, nausea, and retching which often lasted for ten minutes after the injection, and in a few cases by a collapsed condition which was but slowly recovered from. On the suggestion of my friend Sir Leonard Rogers, the sodium salt of antimony tartrate was substituted as being just as efficacious and far less toxic, and for the past three years this salt has been regularly employed with most excellent results, nausea followed by retching being very rarely met with, and no cases of collapse have occurred.

Having personally given considerably more than 3,000 intravenous injections, and having watched the effects of double that number given by my assistants when officiating as civil surgeon of the Nowgong district of Assam, I am convinced that in the sodium salt of antimony tartrate we possess the means of curing the vast majority of cases of kala-azar that come up for treatment, and, provided that the cases are secured in the early stages of the disease, the course is by no means a prolonged one.

A young tea-planter who contracted the disease at the end of last September (diagnosis confirmed by Sir Leonard Rogers) was perfectly fit again before Christmas Day, having received twenty-one injections, which represented a total of 25 grains of the sodium salt. He was free from fever after the third injection. He was in excellent health when heard from a few days ago. Beyond an occasional saline purge, no other treatment whatever was adopted. In another case of kala-azar in a European (diagnosis confirmed by Major Knowles, I.M.S., pathologist to the Government of Bengal, who treated him in Calcutta), the patient lost his fever after three injections, though he had been ill for some weeks. In order to secure a passage to England he left before the cure was completed, and though he put on two stone in weight on the voyage home, he relapsed soon after his arrival early in July. He was having persistent and moderately high fever when he came to London on July 28th to be under my care. After the seventh injection of the sodium salt of antimony he lost his fever and has remained quite free. Between August 1st and August 5th the temperature ranged between 101° and 104°, and the patient was very ill and depressed. He has now had thirteen injections, and is getting 1½ grains of the sodium salt in 10 c.cm. of normal saline at each dose. It is my intention to continue treatment for at least another month, giving the injections at longer intervals and in gradually decreasing doses. The injections were given every other day between July 28th and August 12th, as it appeared essential to sterilize the patient as rapidly as possible compatible with safety. The initial dose was 4 c.cm. and increased by 1 c.cm. at each injection, the strength of the solution being the same—namely, 1½ grains dissolved in 10 c.cm. of normal saline, so that the initial dose represented three-fifths of a grain. My point in referring to these two cases is to show that with the sodium salt the fever in kala-azar, even where the case is not of recent origin, is often lost quite as speedily as in the case successfully treated by acetyl-p-aminophenyl stibiate of soda referred to by Dr. Manson-Bahr in your issue of August 14th, p. 235.

Referring to Dr. Christopherson's letter, I would like to say that no difficulty whatever has been found in procuring regular supplies of the sodium salt in Assam; that I invariably prepare my own solutions, using normal saline in which to dissolve the drug, and then sterilizing by placing the bottle containing the solution in a saucepan, the water in which is brought to the boil and kept at boiling point for ten minutes. The solution can be repeatedly boiled without destroying its efficacy. As most of these injections were given in a poorly equipped tea estate coolie hospital, the conditions were not ideal. The median basilic vein was usually selected and the skin over the vein painted with iodine. The injections were always given when the patient's stomach was empty, and he was made to lie down for half an hour afterwards. If there was the slightest tendency to coughing after an injection, the assistant noted the patient's name, and the dose for that patient was reduced at the next injection by ½ c.cm. With the sodium salt that was rarely necessary, whereas with the potassium salt coughing often ensued immediately the needle was removed from the lumen of the vein. The majority of cases were cured after a course of 30 grains—1½ grains in 10 c.cm. of normal saline being regarded as the full dose, and the initial dose usually being 4 c.cm. of this amount. A patient was considered cured provided that in addition to freedom from fever for a considerable period there was marked diminution in the size of the spleen, and that no reaction followed an injection of antimony. It is not always desirable to puncture the spleen repeatedly, but where Leishman-Donovan bodies are still present there is usually a rise of temperature shortly after an injection;

and though this reaction is often very slight and transient, its presence denotes that treatment must not be discontinued. In conclusion, injections of the sodium salts of antimony are, in my opinion, a perfectly safe form of medication even in advanced stages of kala-azar, provided due care is taken at the time of injection to note the effect of each dose.—I am, etc.,

Harrow, Aug. 27th. J. DODDS PRICE.

MORTALITY OF VENEREAL DISEASE.

SIR,—The correspondence on this subject has been of great interest and value as establishing beyond "all possible probable shadow of doubt" the unreliability of the Registrar-General's death rate returns in regard to syphilis or the effects of syphilis, the terrible toll taken by what Sir James Crichton-Browne so aptly calls the "hidden hand of pathology," and the inaccuracy of statement and futility of argument advanced by Mr. Charles Russ in his endeavours to camouflage his indefensible position from the heavy artillery brought against him.

Syphilis produces its degenerative effects owing to the proliferative endarteritis and perivascular infiltration with plasma cells and lymphocytes, which interfere with the nutrition of the parts supplied by the affected blood vessels. Every tissue and organ is therefore liable to suffer, and it is doubtful if there is any other chronic infectious disease with so wide and harmful a field for its attacks. To demand pathological proof by the demonstration of the *Spirochaeta pallida* in all such lesions is unreasonable, and as logical as to demand proof of the presence of alcohol in the liver of a case of alcoholic cirrhosis of the liver. Yet this proof is what Mr. Charles Russ asks for in your issue of August 21st.

Mr. Charles Russ should collaborate with Lord Astor, who advanced as serious evidence against the increase of venereal disease since the outbreak of the late war the fact that the death rate from general paralysis had not increased—the average date for the onset of which is, I believe, about ten years after infection! Those who wish to try to prove that venereal disease is a bogey to frighten amorous adolescents with should really be more careful of their "facts" and arguments.—I am, etc.,

London, W., Aug. 30th. H. WANSEY BAYLY.

CORONERS' INQUESTS.

SIR,—I think it is high time that the Association should take up the question of the payment of fees for attending inquests, and the giving of evidence by honorary medical officers of hospitals. I have recently had to attend two in one week—one being a lengthy inquiry. In both cases I had attended the patients in my capacity as medical officer to our local hospital. One—a case of very severe burns in an elderly man—I had attended at the patient's house (he was a patient of mine) and ordered his removal to hospital, where I attended him until his death. The other was a case of drowning which happened to be admitted whilst I was on my visiting round at the hospital. The coroner said he was very sorry that he should take up my valuable time without any fee, but he had no power to give one. He added, "It is a matter that your Association should take up with the authorities." I heartily concur with him.

The time that honorary medical officers give to attendance on patients in hospitals free, if calculated in £ s. d., would amount to a heavy item in twelve months. To expect us, in addition, to attend courts without recompense is a flagrant instance of abuse which no other profession would tolerate.—I am, etc.,

Colwyn Bay, Sept. 9th. J. H. MORRIS-JONES.

*** The British Medical Association long ago anticipated Dr. Morris-Jones's wishes. Since 1909 the Council has been trying to induce the Government to alter the law as to death registration and coroners, but the Government has never been able to find time for it. The particular grievance to which Dr. Morris-Jones alludes has been denounced by two departmental committees, and was again brought to the notice of the Minister of Health and the Home Secretary by the deputation from the Association which was reported in the SUPPLEMENT of August 14th, 1920.

TREATMENT OF CALCULI IMPACTED IN THE PELVIC PORTION OF THE URETER.

SIR,—In the discussion on the treatment of calculi impacted in the pelvic portion of the ureter, opened by Mr. Frank Kidd at the annual meeting of the British Medical Association at Cambridge, and continued in the letter appearing in the JOURNAL of August 28th, it is strange that no mention has been made of the danger of paralysing the ureteric sphincter by cutting it with scissors, burning it with the diathermic electrode, or leaving a tent for twenty-four hours within the bladder portion of the ureter.

Transplantation of the ureter without its vesical sphincter into another portion of the bladder, or into the rectum or skin, is commonly followed by an attack of acute pyelonephritis. Therefore any injury to the sphincter, be it only temporary, may occasion an ascending infection and subsequent attack of acute pyelonephritis.

The more modern methods of dealing with stone in the pelvic portion of the ureter are only successful when due regard is given to the delicacy of the operation and the importance of preserving intact the ureteric sphincter.—I am, etc.,

CLIFFORD MORSON, O.B.E., F.R.C.S.

London, W., Sept. 1st.

TREATMENT OF GONORRHOEA IN WOMEN.

SIR,—I crave a little space to reply to Dr. Samuels (September 11th, p. 413). As one must not indulge in unnecessary verbiage, I endeavoured to be terse and concise, but unfortunately have evidently obscured my meaning in dealing with the above subject (August 21st, p. 295). I will try to be more explicit and lucid. The point at issue was whether gonorrhoea in the female is more difficult to cure than in the male. I demurred from "that widely accepted conclusion," and still do so. Dr. Samuels will surely admit that because a fact is "widely accepted" it is not therefore free from contradiction. I need not labour that point. In my opinion the error arose from a fallacious contrast and comparison between *acute* gonorrhoea in the male and *chronic* gonorrhoea in the female. Venereologists are aware of the intractability of a good many cases in the male, and no doubt some of your readers will recall being associated with me in the treatment of patients who have had the disease for many years. The cause of the chronicity is always due to an undiagnosed and untreated focus of disease, whether in the prostate, vesicles, verumontanum, Cowper's glands, lacunae, or urethra. The moment this focus is destroyed cure takes place. A similar state of affairs exists in the female.

If your correspondent will kindly refer to my letter again, he will see that I did not "wisely abstain from giving my successful treatment" in chronic gonorrhoea; I stated "that, excluding repeated reinfections, the chronic form is due to an undiagnosed source of infection, which focus must be searched for and destroyed." Whether this is a pyosalpinx, an oöphoritis, endometritis, cervicitis, cervical erosion, bartholinitis, inflamed Skene's tubules, warts, or urethritis, it requires the proper treatment. The pyosalpinx must be removed, endometritis or cervicitis curetted, Bartholin's glands cauterized or excised, Skene's tubules obliterated, warts soaked in lactic acid as recommended by Watson, and so on. The ideal treatment, however, is prevention, and that is obtained by treating the acute condition in the manner I outlined. I quite agree with Dr. Samuels that the cervix is involved in the majority of acute cases, and I should have mentioned that after swabbing the vagina I expose the cervix through a Fergusson's speculum and swab with a cotton-wool tipped probe dipped in a strong acriflavine solution, taking care not to go beyond the internal os. In old-standing cervicitis the curette is the best remedy. The vaginal epithelium is at first resistant to the gonococcus, but after a time this resistance is lost, small erosions occur, and the germ penetrates the tissues. Packing prevents the vagina acting as a cesspool and drains the cervix by capillary action.

I might add that by combining acriflavine with normal horse serum in equal parts, a solution as strong as 1 in 100 can be used without deleterious effect. I have used this combination in the abortive treatment of acute gonorrhoea in the male, without producing pain, dysuria, or retention. As regards the differential diagnosis of the chronic form in the female, I stated "to treat gonorrhoea successfully in

women, the venereologist must have a sound knowledge of gynaecology"; that knowledge will enable him to diagnose, say, a pyosalpinx from a urethral caruncle. Dr. Samuels surely does not wish me to discuss the differential diagnosis of each condition I have mentioned; if he did, and I acquiesced, I am certain your readers would weary.—I am, etc.,

Manchester, Sept. 13th. M. W. BROWDY, M.B.

PLEURAL REFLEX SYNCOPE.

SIR,—Perhaps the following notes may be of interest in this connexion. I am writing from memory, but the case was so unusual that one does not forget it.

A good many years ago, when I was an assistant in private practice, a boy aged 5 years suffered from right lobar pneumonia followed by empyema, which was treated at home by the principal and myself. Thoracotomy in the posterior axillary line was done under chloroform, allowing of the exit of a fair quantity of pus. The boy got over the operation well enough; the wound discharged a good deal daily. About the fifth day after the operation it was decided to try the effects of syringing with an antiseptic lotion in the hope of lessening the discharge. The syringe used was the ordinary wound syringe, and the lotion warm boracic. The boy was progressing, eating and sleeping well; there was no other complicating factor. The dressings were removed in the usual way, but on this occasion the syringing was to be done. However, no sooner had a small quantity of the lotion been injected than the boy rolled over on his back dead.

What was the cause of this instantaneous death? Here there was no anaesthetic, nor sudden alteration in the position of the heart, nor other factor which one usually associates with sudden death in empyema. Apart from the fact that washing out the pleural cavity is often done, but always under low pressure and with a good exit, possibly the two factors concerned in this case were (1) the syringe, and (2) an inflamed or congested *visceral* pleura. The sudden impact of the lotion from the syringe upon a *small* area of congested visceral pleura possibly overstimulated the inhibitory action of the vagus, thereby causing sudden death.—I am, etc.,

Montrose, Aug. 23rd. A. R. JOHNSTON, M.A., M.B.Edin.

CAN ONE WORK WITH INTRACAPSULAR FRACTURE OF THE FEMUR?

SIR,—In 1881 or 1882 an elderly, tall and rather slight man, following the occupation of messenger at the Houses of Parliament, came to the casualty department of King's College Hospital. He had come down heavily from one step to the next below upon one of his feet, and felt pain and diminished power in the hip of the same side. He walked with the aid of his stick from Westminster to the hospital, then situated in Portugal Street, Lincoln's Inn, a distance of at least a mile. The resident surgeon on duty, after consulting with some of his colleagues—the case being somewhat obscure—decided to admit the patient. He died in a few days. The *post-mortem* examination revealed the existence of a complete fracture through middle of neck of femur, not impacted.—I am, etc.,

Farningham, Sept. 11th. T. F. HUGH SMITH.

ANAESTHESIA IN TONSIL AND ADENOID OPERATIONS.

SIR,—I was much interested in Mr. Courtenay Yorke's notes on anaesthesia in tonsil and adenoid operations (BRITISH MEDICAL JOURNAL, August 28th, 1920). Personally, I used to give nitrous oxide gas to children over 12 rather than under 14, and open other to the younger ones, but after the correspondence in the BRITISH MEDICAL JOURNAL last autumn I began to use ethyl chloride, and have used it entirely in the out-patient department this year. Having now given nearly 300 administrations, I think I may say how satisfactory it has been; I have had little cause for anxiety and have had no bad results. It certainly has been a time-saver in the out-patient department, and in my opinion the duration of the anaesthesia has been longer than with gas and has been more constant, as with gas some patients came out sooner than others.—I am, etc.,

Chester. Sept. 13th. CHARLES JEPHCOTT.

Obituary.

ROBERT CAMPBELL, B.A., M.B., F.R.C.S.ENG.,

Surgeon to the Royal Victoria Hospital, Belfast.

IT is with deep regret that we record the death of Mr. Robert Campbell, M.B., F.R.C.S.Eng., in his 55th year, at his residence, 22, College Gardens, Belfast, on September 6th. Some years ago Mr. Campbell had a severe motor accident when returning one night from an operation in the country; help was not at hand, and he was severely chilled, and did not recover consciousness for some days; this may have laid the seeds of his Bright's disease, or intensified it; however, he recovered, and undertook full duty in all his appointments. In March of this year he suddenly developed a uraemic condition, and was ill for some months, but although he was weakened he resumed work. A fortnight before his death another attack supervened, and he gradually sank.

Robert Campbell was the second son of the late Rev. Robert Campbell, of Templepatrick, County Antrim, and his family can trace connexion with this district back to the days of the Ulster Plantation. He had a most distinguished college and university career, both in arts and medicine; he was an excellent classical scholar, and the foundation of this acquirement was no doubt laid by his father's aid and influence; he took prizes, scholarships, and exhibitions from year to year, both in arts and in medicine; in the final examination for the M.B. degree he obtained first place and an exhibition. He was appointed demonstrator of anatomy in the Queen's College, Belfast, and subsequently resident to the Chester Infirmary; in 1896 he obtained the F.R.C.S.Eng., and settled in Belfast as a surgeon. After filling the junior posts, he became full surgeon to the Royal Victoria Hospital, Belfast, and to the Queen Street Hospital for Sick Children, and his work in both institutions was distinguished by great skill, meticulous care, originality, and by what might be termed a restrained and discriminating boldness. He was among the first to use india-rubber gloves, and early introduced them into the Belfast school. As early as 1898 he operated for perforating typhoid ulcer. In 1910 he distinguished clearly between acute appendicitis and acute appendicular obstruction, and put his proofs so vividly before the profession that he was undoubtedly the first to insist on the difference in the pathology, symptoms, course, and dangers. His operations for congenital hernia in infants were numbered by the hundred, and while high surgical authority was laying down rules as to age and other limitations, he was performing them in a steady stream, regardless of such restrictions and with convincing success. His work and operations on thyroidectomy were also characterized by the same fullness, completeness, and success. Mr. Campbell was also surgeon to the Ulster Volunteer Force Hospital, and gave his skill and experience ungrudgingly to the wounded soldiers and pensioners. He was an ex-president of the Ulster Medical Society in 1916–17, and of the Ulster Branch of the British Medical Association in 1918–19, and his opening address on both occasions was marked by wide experience, a penetrating and scientific intellect, and philosophic breadth. During the latter years the strain of a large consultant and operative practice, and perhaps the insidious development of his disease, kept him from publishing his views and results with the fullness that their importance demanded. In his younger days, also, his teaching of surgery was described as perfect; latterly he evidently felt the necessity to economize his strength, but still at times spoke with that clearness, brevity, and discernment that said what was necessary and omitted what was unnecessary. At times he was the most silent of men, but to the last his personal friends enjoyed the keen perception, the silent humour, the straightforwardness, and yet the broad charity of his conversation.

Mr. Campbell was a leader among the band of surgeons, trained in anatomy under the late Professor Redfern, that revolutionized surgery in the Belfast school. He had the rare combination of a large brain, practical common sense, unerring instinct, and well trained hands. His friends will miss his true devotion, and the profession and public, for whom he worked as long as strength lasted, a most trustworthy, skilled, and high-principled servant. He

married Miss McTaggart, who was matron of the Queen Street Children's Hospital, whose devotion to her husband was measureless, and with whom the deepest sympathy is felt. He is survived by his elder brother, Dr. John Campbell, F.R.C.S.Eng., operating gynaecologist, of Belfast, and two sisters.

DR. RUTHERFORD HARRIS, who died on September 1st after a long illness, was born in 1856, the son of a judge of the Supreme Court of Madras. He received his medical education in Edinburgh, and after taking the diploma of L.R.C.S. there he was induced by the state of his health to go to South Africa. At Kimberley, where he practised, he became intimately associated with Cecil Rhodes and Jameson; he accompanied the latter on his mission to Lobengula at Bulawayo in 1888, and on the formation of the British South Africa Company became its secretary in South Africa. He took a considerable part in organizing the Jameson raid in 1895, with the result that his connexion with the British South Africa Company ceased. He had been elected to the Cape Parliament as one of the representatives of Kimberley, and was a whip of the Progressive Party in Rhodes's administration. He came to this country in 1900, and after one abortive attempt entered the House of Commons as M.P. for Dulwich in 1903. He retired in 1906, and had since lived very quietly at Llangiby Castle, Usk, Monmouthshire.

Universities and Colleges.

UNIVERSITY OF LONDON.

Advanced Lectures in Physiology.

THE following courses are announced for 1920–21:

Dr. C. Da Fano: Histology of the nervous system; eight lectures, accompanied by demonstrations of specimens, at 4.30 p.m. on Wednesdays, beginning October 13th (King's College). Professor A. D. Waller (in conjunction with Mr. J. C. Waller, M.A.): Eight lectures on Experimental studies in vegetable physiology and vegetable electricity, on Tuesdays, beginning October 12th (University Buildings). Professor M. S. Pembrey: Eight lectures on The physiology of the embryo, fetus, and newly born, on Thursdays at 4.30 (Guy's Hospital, second term). Mr. J. A. Gardner: Eight lectures on Biochemistry (title and place to be arranged). Professor H. E. Roaf: Eight lectures on Reception of sensory stimuli (London Hospital, third term. During the second term a course of eight lectures by various lecturers will be arranged by Professor Bainbridge at St. Bartholomew's Hospital.

ROYAL FACULTY OF PHYSICIANS AND SURGEONS OF GLASGOW.

AT the monthly meeting of the Faculty, held on September 6th, Dr. John Browulee, Director of Statistics, Medical Research Council, was admitted an honorary Fellow, and Dr. B. W. H. Fergus was admitted (after examination) a Fellow.

The Services.

HONOURS.

Victoria Cross.

IN a Supplement to the *London Gazette* dated September 9th, 1920, it is announced that His Majesty the King has been graciously pleased to approve of the following award of the Victoria Cross:

The late Temporary Captain HENRY JOHN ANDREWS, M.B.E., Indian Medical Service.

For most conspicuous bravery and devotion to duty on the 22nd October, 1919, when as Senior Medical Officer in charge of the Khajuri Post (Waziristan) he heard that a convoy had been attacked in the vicinity of the post, and that men had been wounded. He at once took out an Aid Post to the scene of action and, approaching under heavy fire, established an Aid Post under conditions which afforded some protection to the wounded but not to himself.

Subsequently he was compelled to move his Aid Post to another position, and continued most devotedly to attend to the wounded.

Finally, when a Ford van was available to remove the wounded, he showed the utmost disregard of danger in collecting the wounded under fire and in placing them in the van, and was eventually killed whilst himself stepping into the van on the completion of his task.

DEATHS IN THE SERVICES.

Deputy-Surgeon General Charles Thomas Paske, Bengal Medical Service (retired), died on April 10th, 1920, aged exactly 90 years. He was born on April 10th, 1830, and educated at the Middlesex Hospital, taking the M.R.C.S. in 1852, nearly seventy years ago. He entered the I.M.S. as assistant surgeon on August 26th of the same year, became surgeon in 1864, and surgeon-major in 1872, and retired with the honorary rank of D.S.G. on January 1st, 1879. He served in the second Burma war of 1853 (medal); in the Indian Mutiny in 1857–58, including the actions at Ghaga, Kudwa, and Chauda (medal); and on the north-east frontier in the Bhutan campaign of 1865–66 (clasp). He was the author of *Myamma, Life and Travel in Lower Burma*, 1892, and (with F. G. Aflalo) of *The Sea and the Rod: a Handbook to British and other Seafishing*, 1892. Since the death of Surgeon-General Sir Alexander Christison, nearly two years ago, he had been the senior member of the I.M.S. on the retired list, and his death leaves only one survivor of the Mutiny still living of the I.M.S., Deputy Surgeon-General P. W. Sutherland.

Captain Charles A. Skelly, R.A.M.C., died in Dublin on June 28th. He was educated in the medical school of the Royal College of Surgeons in Ireland in Dublin, took the L.R.C.P. and S.I. in 1894, and, after serving as resident midwifery assistant at the Coombe Hospital, Dublin, went into practice at Oldcastle, County Meath, where he was medical officer to the workhouse and to the Royal Irish Constabulary. He took a temporary commission as lieutenant in the R.A.M.C. on August 8th, 1917, and became captain a year later.

Major Joseph Lee, I.M.D., died at the British Station Hospital, Murree, on August 6th, aged 50. He was born on March 10th, 1870, entered the I.M.D. as a warrant officer in February, 1889, got his commission on June 26th, 1908, having gained nine years by a special promotion for field service, and became captain in 1912, major in 1917. He had served on the North-West Frontier of India in 1908, and also in the recent war.

Medico-Legal.

A BOGUS DOCTOR.

AT the York police-court on September 6th a man named Mellor, described as a clerk of no fixed abode, was charged with being a suspected person and frequenting Duncombe Place with intent to commit a felony. According to the report in the *Yorkshire Herald*, the Chief Constable said the prisoner had been going round York visiting nursing homes, and purporting to be a doctor. A house-surgeon of the County Hospital gave evidence to the effect that the prisoner called at the hospital representing himself as a house-surgeon from Nottingham, and at his own request was shown round the hospital, after which he left the premises, but called again later in the evening and also next day. The matron of a nursing home stated that the prisoner called there one evening and asked for ether, representing himself as acting for a doctor in York, and later as a student of Guy's Hospital. Two days later he called again in the evening and made some inquiries about a "twilight sleep" home, saying that he was acting in the matter for Dr. Gostling, but the witness on telephoning to Dr. Gostling found this was not correct. The matron of the Duncombe Place Dispensary said the prisoner called there representing himself as a doctor and asked permission to look at the telephone directory. He called again next day, and on the day after he entered the dispensary without permission, and, in reply to the witness's question, said "I am a doctor." The police were telephoned for, and arrested Mellor as he was leaving the premises. A detective-sergeant said that when taken into custody the prisoner had in his possession a case of surgical instruments. Witness handed in a list of nine previous convictions for fraud, false pretences, and theft in various towns. Mellor was sentenced to three months' hard labour.

Medical News.

ON the invitation of the Neurological Section of the Royal Society of Medicine, Dr. Henry Head, F.R.S., will deliver the Hughlings Jackson Lecture at 1, Wimpole Street, on October 7th, at 8.45 p.m. The subject of the lecture will be "A new conception of aphasia."

THE Ministry of Health and the Scottish Board of Health are prepared to receive applications from voluntary hospitals for grants in respect of payment of duty involved by the use of duty-paid spirit or drugs containing duty-paid spirit for medical and surgical purposes in these hospitals during 1919. Forms of application have been sent to those hospitals to which a grant was paid last year. Any other hospital desiring to apply should communicate immediately with the Secretary to the Ministry of Health, Whitehall, S.W.1, or to the Secretary to the Scottish Board of Health, Edinburgh, as the case may be.

A POST-GRADUATE course in neurology will be given from October 4th to December 10th, at the National Hospital for the Paralysed and Epileptic, Queen Square, Bloomsbury, W.C. Lectures, demonstrations, and out-patient clinics will be given on the afternoon of each week-day. The fee is seven guineas; a special fee is payable by those wishing to undertake practical pathology.

WITH the approval of the Minister of Public Health, and in order to initiate research into the etiology of goitre, New Zealand practitioners have been asked to furnish voluntary notifications (for which payment is made) of cases of this disease.

THE National Association for the Prevention of Infant Mortality and for the Welfare of Infancy, of which Dr. G. F. Still is chairman, has arranged a course of lectures on infant care for health visitors, nurses, midwives, infant welfare workers, etc., to be held at University College, Nottingham, from September 20th to 24th inclusive. A course of elementary lectures on infant care will be given at Morley Hall, George Street, Hanover Square, W., on Mondays, at 6 p.m., from September 27th to December 13th. In conjunction with the National Society of Day Nurseries, a course of lectures on infant care will be held at the Essex Hall, Essex Street, Strand, W.C., on Thursdays, at 7.30 p.m., from September 30th to December 16th. Information regarding these courses may be obtained from the Secretary, Miss Halford, 4 and 5, Tavistock Square, London, W.C.1.

THE first year's work of the Association of Certified Blind Masseurs was completed on July 22nd. The membership of the association comprises soldiers blinded in the war and trained at St. Dunstan's, as well as civilian masseurs and masseuses trained at the National Institute of the Blind or under its auspices.

THE new orthopaedic hospital at Newcastle-on-Tyne, forming an extension of the Royal Victoria Infirmary, was opened on September 9th by the Duke of Northumberland. The new buildings, which contain 540 beds, occupy an area of some fifteen acres, and have been erected at a cost of £160,000, towards which some £148,000 have been subscribed. The hospital has been in occupation for the past year under the Ministry of Pensions.

IN the fifty-fourth annual report of Dr. Barnardo's Homes (National Incorporated Association) a deficiency of £22,337 10s. 6d. is reported for 1919. In memory of the founder, an effort is being made to raise 300,000 half-crowns for the children's food bill fund. Subscriptions may be sent to the honorary director at 18, Stepney Causeway, E.1.

DR. ÉTIENNE LOMBARD, the well known Paris oto-rhino-laryngologist, and for fifteen years editor of the *Annales des maladies de l'oreille et du larynx*, has recently died at the age of 51.

Letters, Notes, and Answers.

As, owing to printing difficulties, the JOURNAL *must be sent to press earlier than hitherto, it is essential that communications intended for the current issue should be received by the first post on Tuesday, and lengthy documents on Monday.*

ORIGINAL ARTICLES and LETTERS *forwarded for publication are understood to be offered to the* BRITISH MEDICAL JOURNAL *alone unless the contrary be stated.*

CORRESPONDENTS who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

AUTHORS desiring reprints of their articles published in the BRITISH MEDICAL JOURNAL are requested to communicate with the Office, 429, Strand, W.C.2, on receipt of proof.

IN order to avoid delay, it is particularly requested that ALL letters on the editorial business of the JOURNAL be addressed to the Editor at the Office of the JOURNAL.

THE postal address of the BRITISH MEDICAL ASSOCIATION and BRITISH MEDICAL JOURNAL is 429, Strand, London, W.C.2. The telegraphic addresses are:

1. EDITOR of the BRITISH MEDICAL JOURNAL, *Aitiology, Westrand, London;* telephone, 2631, Gerrard.
2. FINANCIAL SECRETARY AND BUSINESS MANAGER (Advertisements, etc.), *Articulate, Westrand, London;* telephone, 2630, Gerrard.
3. MEDICAL SECRETARY, *Medisecra, Westrand, London;* telephone, 2634, Gerrard. The address of the Irish Office of the British Medical Association is 16, South Frederick Street, Dublin (telegrams: *Bacillus, Dublin:* telephone, 4737, Dublin), and of the Scottish Office, 6, Rutland Square, Edinburgh (telegrams: *Associate, Edinburgh;* telephone, 4361, Central).

QUERIES AND ANSWERS.

"PARENT" inquires how the climate of Kandy, Ceylon, is likely to suit a well-compensated case of mitral regurgitation in a woman of 30, a teacher who plays tennis, hockey, and other games, but who is rather subject to insomnia; also if there is malaria in Kandy.

DR. E. J. BOYD (Pudsey) asks whether any reader can tell him of a bedpan, with straight sides for easy cleansing, and fitted at the top with a pneumatic rubber cushion which can be easily taken off when deflated.

INCOME TAX.

"A. B." is a retired Government medical officer drawing income from pension and investments at home and abroad, which are taxed at the source, and doing some consulting work. What deductions is he entitled to?

*** The only advice that we can give is that he is entitled to deduct such expenses as are reasonably incurred in earning the year's income—for example, the running cost of his motor car can be deducted so far as it is incurred on professional journeys, but not the initial outlay; similarly with the household expenses, if the professional portion necessitates the keeping of an additional maid, the cost of her wages and keep can be deducted. So far as the income from investments is concerned, if "A. B." states clearly on his declaration of income that it is subjected to British income tax before it reaches him, there is not much likelihood of its being again charged.

"DERMIENSIS" inquires as to his right to deduct as professional expenses (1) the cost of purchasing and installing a complete *x*-ray apparatus, and (2) the expense of altering and repainting a room to enable the apparatus to be installed.

*** The expenditure on (1) represents an outlay of capital, not an expense of the year's working, and is not admissible as a deduction. So far as (2) is concerned the same rule applies, except that to the extent to which the adaptations in question rendered unnecessary the expenditure of repairing or replacing the existing furniture or decorations some claim might be made out to an allowance on that ground. We advise our client to watch for any change in the present restriction of the depreciation allowance; if the recommendations of the Royal Commission on Income Tax are to be put into force, our correspondent will be entitled then to an allowance for the annual depreciation of the apparatus as measured by its present cost and probable life.

"W. A." has been asked by the inspector of taxes to give a written undertaking "to pay over to the Revenue any income tax that may be due by reason of any increase in the value of book debts which has not previously been brought into account for income tax purposes and on which tax has not been paid." What is "W. A.'s" best course of procedure?

*** The basis and implication of the request for this undertaking is that at present "W. A." is, or is likely to be, insufficiently assessed to income tax. The only circumstances which would justify it are, we conceive, that he is commencing in his present practice and is making his declaration on the basis of his cash receipts; in the first three or four years of a new practice the cash receipts do not furnish a true index to the real earnings, and the ordinary practice of inspectors is, we believe, to claim to put the receipts on the value of the total bookings rather than on the actual cash receipts until the process of time has brought the cash takings up to a normal level—a period of from three to five years, according to the circumstances of the practice. Difficult as is the valuation of a practitioner's bookings, this method seems to us preferable to calling for an undertaking to put the matter right by an adjustment to be made at some indefinite future date. If our correspondent has been in his present practice for some years, we see no justification for the request at all. In that case the unpaid bookings of any particular year may be presumed to be counterbalanced by the payment in that year of debts incurred by patients in previous years, and the cash basis is a true index of the total earnings of the practice. We suggest that our correspondent might ask the inspector for the grounds on which it is assumed that his present assessments are insufficient.

PERSISTENT GINGIVITIS AND LINGUAL NEURALGIA.

"T. D. H." asks for suggestions in the following case of chronic neuralgia of the tongue (six years' duration) with persistent gingivitis: The affection began in November, 1914, following an abscess in connexion with a wisdom tooth. One morning the patient, aged 50, woke up with severe pain in the tongue; this continued for a few days, stopped for a fortnight, and since then has been continually present in the daytime. There are no tender points; the patient can sleep, but as soon as he uses the tongue the pain recurs and makes life a burden to him. The tongue is normal in appearance; common sensation and sense of taste are normal. There is no specific history, and the Wassermann reaction is negative; the knee-jerks and other reflexes are normal. The general health is good. The following treatments have been tried: strychnine and other tonics; codeia, potassium iodide, bromides and arsenic; butyl chloral, pyramidon, aspirin, and salicylates; insufflations of morphine, cocaine, etc. Twelve months ago injection of the lingual nerves with

alcohol was undertaken; this was without benefit, but there is some doubt whether it was efficiently done. More recently the patient came under the writer's care. As some of his teeth appeared septic they were extracted, and a vaccine (of pure streptococci) was prepared from the sockets. This gave some relief, and the rest of his teeth have since been extracted with further advantage. The neuralgia, though much less severe, still persists, and would seem to depend on persistent inflammation of the lower gums; the upper ones are normal. The patient does not use his false teeth, and eats minced food only. Our correspondent asks for any suggestion for treatment of this persistent gingivitis or any record of the experience of a similar case of neuralgia of the tongue. The patient cannot tolerate peroxide of hydrogen or any of the commonly used lotions, which irritate the gums and increase the neuralgia.

LETTERS, NOTES, ETC.

HABITUAL DRUNKENNESS AND THE PUBLIC HEALTH AUTHORITY.

MAJOR-GENERAL SIR GEORGE EVATT, K.C.B., M.D., A.M.S. (ret.), writes: Nothing is more common than to see inebriates brought up time after time before the magistrates' court and fined and discharged. The fine may not act in any way as a check. I suggest the following procedure: When the magistrate inflicts a fine for drunkenness a copy of the magistrate's decision should be sent *officially* to the public health authorities where the fined person resides. The medical officer of health on receipt of the document should detail a male or special female health visitor to visit the home of the convicted person, caution them as to the danger of drunkenness, and, if the family be poor or in poverty-stricken conditions, the responsible parent should be taken before the magistrate for such action as he thinks fit. All this would tend to waken up the drunkard and perhaps check intemperance.

ROYAL EARLSWOOD INSTITUTION.

DR. C. CALDECOTT, medical superintendent of the Royal Earlswood Institution, in writing to offer the best thanks of himself and his Board of Management for our article in last week's JOURNAL (p. 407), asks us to state that the legacy from the late Mr. Ray has not crystallized. Owing to a flaw in the naming of the institution there has been, and still is, great delay, and it may even happen that the legacy will not in the end be forthcoming. All this, Dr. Caldecott adds, is very harassing, especially since the proceeds of the bequest are so essential if the institution is to maintain its usefulness as in the past.

MEDICAL POLICE FEES.

DR. A. WITHERS GREEN (London, W.) writes: Since I sent you my letter printed last week, an order has come round to all *metropolitan* police surgeons, signed by Sir Charles Ballance, the chief surgeon, revising charges for attendance. The 3s. 6d. fee is obliterated. A 5s. fee is granted for day visits; a 10s. 6d. fee is granted for night visits. Will you kindly insert this in your next issue to make it known all over the kingdom?

ERGOT AND IRON MIXTURES.

A CORRESPONDENT recently sent us a copy of the *Bradford Formulary*, 1920, issued by the Bradford Panel Committee for the use of insurance practitioners, and drew our attention to the following prescription, on page 31:

Mist. Ergot et Ferri.

Ext. ergot liq.	℥j
Liq. ferri perchlor.	℥iij
Ac. d. citric.	ʒj
Aq. chlorof.	ad ℥viij

Our correspondent expressed the opinion that notice should be called to this prescription, for, in his opinion, the ingredients are incompatible and form ink. It has often been stated that liquid extract of ergot and liquor ferri perchloridi together produce an inky mixture, probably due to the formation of iron tannate, and the addition of a little citric acid has been recommended in order to prevent this. As the matter is one of general interest, we have referred the prescription in the *Bradford Formulary* to Mr. W. H. Martindale, Ph.D., of New Cavendish Street, who has been good enough to make several experiments. As the result of these he comes to the conclusion that it is a mistake to suggest that this prescription produces ink, for a light-brown precipitate is all that results when it is dispensed. It is indeed doubtful whether the liquid extract of ergot contains much tannin. The precipitation can be prevented to a large extent by the use of a little more citric acid than the amount stated in the prescription. Dr. Martindale has examined four bottles of the mixture:

1. Made without any citric acid.
2. Made with ½ drachm citric acid in 4 oz. of the mixture.
3. " " 1 drachm " " " "
4. " " 2 drachms " " " "

Each mixture has a light-brown colour, and the slight precipitate diminishes as the citric acid is increased. No. 3 has practically no precipitate, and No. 4 remained quite clear after standing for some days. The moral, therefore, is that at least double the amount of citric acid given in the prescription should be used, and a little more will ensure a clear solution.

THE PRODUCTION OF CLEAN MILK.

THE investigations made by the Research Institute in Dairying, University College, Reading (BRITISH MEDICAL JOURNAL, November 8th, 1919, p. 608; June 26th, 1920, p. 876), have shown that the main cause of uncleanliness of milk is contamination on the farm; the harm which is done there cannot be undone by subsequent cooling or other manipulation. Dr. Thomas Orr, medical officer of health to the borough of Ealing, in the *Journal of the Royal Agricultural Society of England*, has entered a plea for more extensive support of research in dairying, and has analysed in terms comprehensible to the agriculturalist the factors which make for uncleanliness of milk. He shows that the milk supply is susceptible of great improvement (without extra expenditure of labour) by the employment of improved methods and the exercise of care. Public health officers, he thinks, have devoted too much attention to the character of the farm buildings and too little to the treatment of the milk itself. Dr. Orr says that little attempt is made, as a rule, to avoid contamination of the exterior of the udder and the neighbouring parts; an investigation is recorded in which cows whose udders had or had not been washed gave milk with bacterial contents of 900 and 17,600 bacteria respectively per cubic centimetre. If the udders are dry brushed before milking some improvement results, but a still greater degree of cleanliness may be obtained by washing with a wet cloth. A preventive measure which is of the utmost practical importance is the restriction of the length of the stall, so that manure falls into the gutter and not on the stall; faecal contamination of the udder when the cow lies down is thus greatly diminished. The use of the covered milking pail and the provision and utilization of an abundant supply of boiling water or steam are regarded by the writer as of greater importance than those improvements in cowhouse construction which have so often been regarded as the essential preliminary to a better milk supply. Dr. Orr has found milk produced by mechanical milkers—the cleansing of which presents great difficulty—to contain as many as 1,392,000 bacteria per cubic centimetre.

TREATMENT OF TYPHUS.

DR. M. ILES (Kamaran) writes: It may perhaps be of interest to state now that, during the typhus epidemic in Serbia, 1914–15, one doctor, who had studied in Paris, reported encouraging results from treatment with arrhénal (monomethylarsenate of soda), but said his cases were too few for certainty. I have forgotten his name, and his records were, of course, destroyed with the other hospital papers before the enemy advance in 1915.

AIR MAILS.

WE abstract the following from the *Handley Page Bulletin*: Any post office will accept letters, postcards, and papers, whether registered or unregistered, for transmission by air; unregistered packets may also be posted in a public letter-box. The post office charges the ordinary foreign postage in addition to an air fee of 2d. per ounce for Paris and Brussels, and 3d. per ounce for Amsterdam. If the special blue label supplied free at any post office is not available, the cover should be marked "By air mail" in the top left-hand corner. For express delivery an extra fee of 6d. per packet is required; the word "Express" should appear below the words "By air mail." Correspondence posted in London in the morning is delivered in Paris or Brussels in the afternoon. The air mails save twenty-four hours in the delivery of correspondence to Switzerland, Italy, Spain, Portugal (via Paris), and Germany, Austria, Hungary, Sweden, and Denmark (via Brussels).

VACANCIES.

NOTIFICATIONS of offices vacant in universities, medical colleges, and of vacant resident and other appointments at hospitals, will be found at pages 33, 34, 37, 38, 39, 40, and 41 of our advertisement columns, and advertisements as to partnerships, assistantships, and locum tenencies at pages 35, 36, and 37.

THE following appointments of certifying factory surgeons are vacant: Chryston (Lanark), Heckington (Lincoln), Staines (Middlesex).

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